THE INSTITUTE OF PETROLEUM

REVIEW

October 1957

V. 11
#130

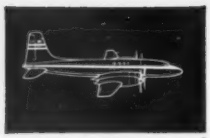
PUBLIC LIBRARY
NOV 6 1957
DETROIT

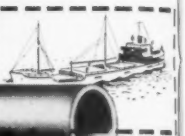
ONE SHILLING AND SIXPENCE

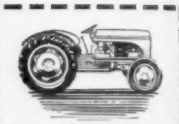
Published by The Institute of Petroleum
26 Portland Place, London, W.1

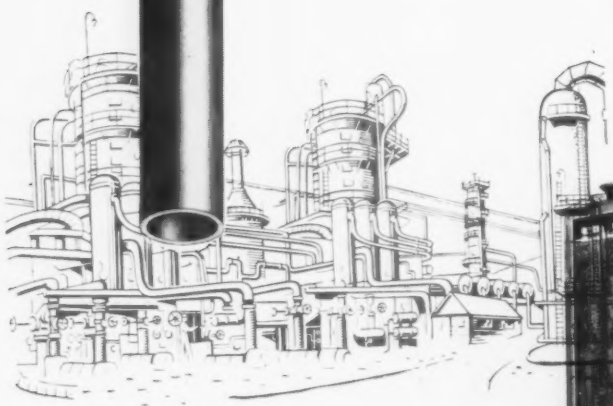
SERCK

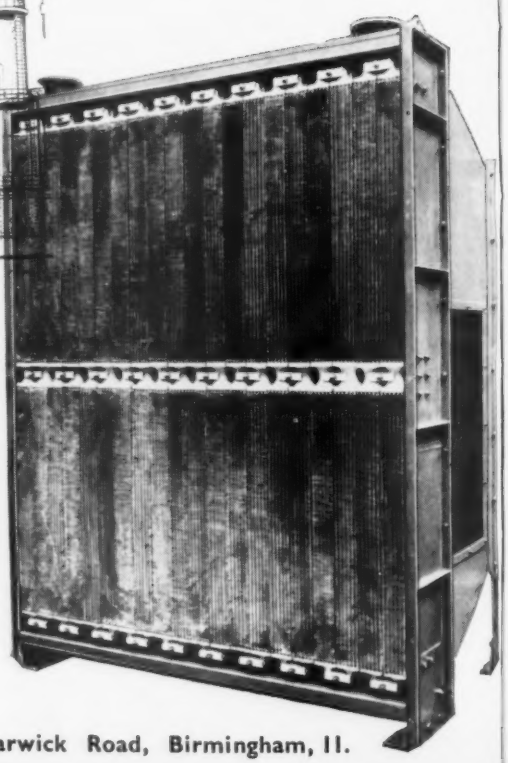
produces for every industry











Serck heat exchangers owe their reliability to Serck non-ferrous tubes used in their construction. Serck tubes are also used in sugar-making machinery, in the Petroleum Industry and in condensers for steam turbines. Serck tubes are manufactured to all accepted international specifications.

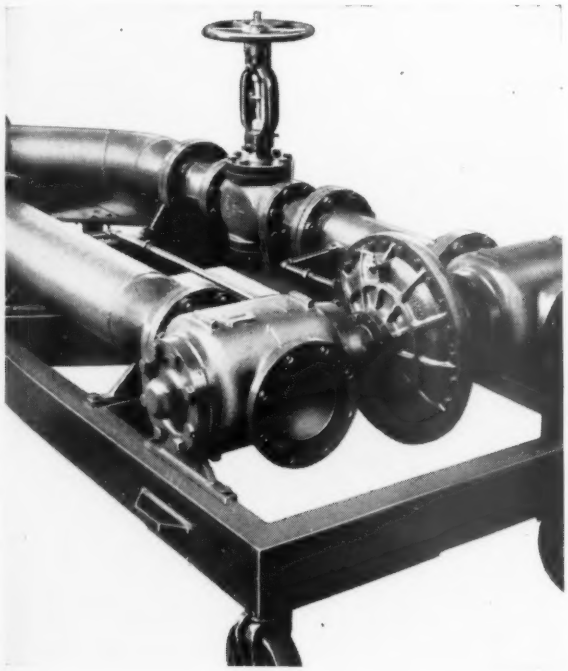
SERCK RADIATORS LTD., SERCK TUBES LTD., Warwick Road, Birmingham, 11.

FISHER

Blending Unit

FOR IN-LINE BLENDING

OF INTERMEDIATE GRADES OF FUEL OIL



Robustly constructed in steel, this unit can be built into a pipeline system or mounted on a trailer and connected by hose. Suitable for the following typical operations:

- IN-LINE BLENDING DIRECT TO SHIP'S BUNKERS
- IN-LINE BLENDING DIRECT TO BULK LIGHTERS OR SMALL CRAFT
- IN-LINE BLENDING DIRECT TO ROAD OR RAIL VEHICLES
- IN-LINE BLENDING DIRECT TO A TANK THROUGH THE NORMAL CONNECTIONS AND WITHOUT RE-CIRCULATION

Write for full particulars to:

FISHER GOVERNOR COMPANY LIMITED

Airport Works, Rochester, Kent (Chatham 3404)

THE INSTITUTE OF PETROLEUM

REVIEW

Published monthly by

THE INSTITUTE OF PETROLEUM

26 Portland Place, London, W.1

'Phone: LANgham 2250

Vol. 11, No. 130 **October 1957**

Contents

OIL FIRING
BY *G. J. Gollin* 263

AROUND THE BRANCHES 275

PERSONAL NOTES 276

NOTES OF THE MONTH 277

ANOTHER PETROLEUM CHEMICAL PLANT AT FAWLEY 278

NEW BOOKS 279

DEVELOPMENTS IN MILFORD HAVEN 280

PETROLEUM REFINING IN IRELAND 281

NEW TANKER FACILITIES AT FALCONARA, ITALY ... 282

PETROLEUM RESEARCH IN ALBERTA 283

COURSES AND FELLOWSHIPS 284

DRILLING BARGE FOR DAS ISLAND 285

OIL COMPANIES EQUIPMENT ORDERS 286

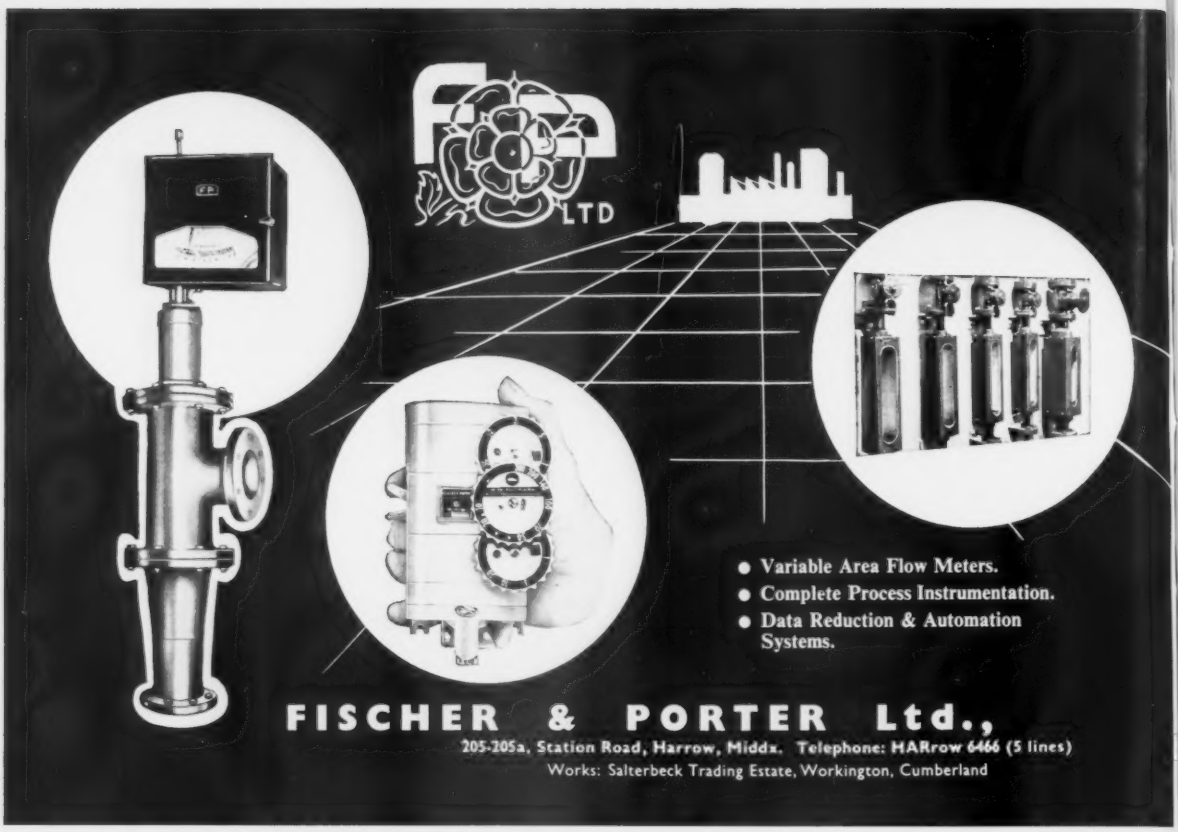
TRADE LITERATURE, ETC. 286

FORTHCOMING MEETINGS 288

Price 1/6 Annual Subscription 15/-, post free

The Institute of Petroleum as a body is not responsible either for the statements made or for the opinions expressed in the following pages.

Printed by
Richmond Hill Printing Works Ltd., Bournemouth


LTD
● Variable Area Flow Meters.
● Complete Process Instrumentation.
● Data Reduction & Automation Systems.
FISCHER & PORTER Ltd.,
205-205a, Station Road, Harrow, Middx. Telephone: HARrow 6466 (5 lines)
Works: Salterbeck Trading Estate, Workington, Cumberland

ISLAND VIEW STORAGE (PTY) LTD

Albany House · Durban · South Africa

BULK STORAGE and TRANS-SHIPMENT

HYDRONYL

THE PIONEERS OF CONTACT RINGS

founded 1914

TOWER PACKINGS

of all types and materials

HY CONTACT

- *LESSING RINGS*
- *RASCHIG RINGS*
- *BERL SADDLES*
- *CATALYST SUPPORT BALLS*
- *HY-MESH RINGS*
- *''SPRAYPAK''*

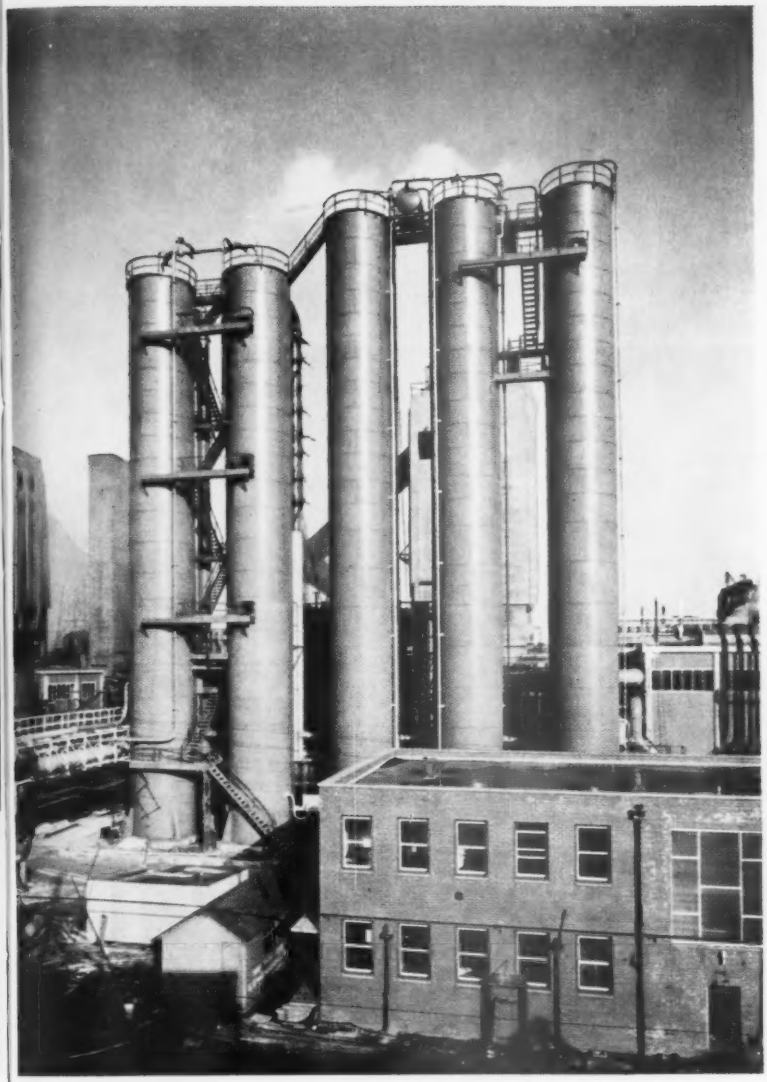
Under licence of U.K. Atomic Energy Authority

THE HYDRONYL SYNDICATE LTD.

14, Gloucester Road, London, S.W.7.

telephone: KNightsbridge 6803

telegrams: Hydronyl, Kens. London



painting this great plant* was a normal operation

With self-contained units placed at strategic points throughout the country — London, Southampton, Ellesmere Port, Grays (Essex), Liverpool, Rochester, Cardiff — and with upwards of 700 operatives with the most modern equipment, we give efficient painting service to most major industries.
A director of the company is available for consultations and a brochure giving details of our work, will be sent on request.

W. J. BROOKER LTD.

FOR PAINTING OPERATIONS OF ALL KINDS

28 WESTMINSTER BRIDGE ROAD, LONDON, S.E.1

Telephone: WATerloo 3911

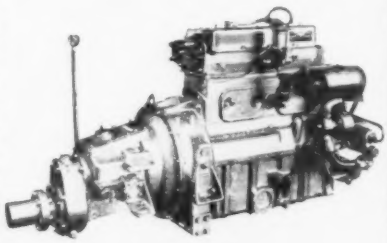
* *National Coal Board Project at Manvers Main, Yorkshire. Main Contractors, Simon-Carves Ltd.*

PERKINS DIESEL AND POWER STANDARDIZATION

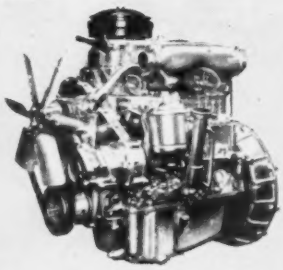
Wherever you use power — in the plant, on site, for transport or marine use, Perkins Diesel engines mean power standardization—and greater economy all round. Maximum interchangeability of engine parts means fewer spares, easier maintenance and quicker turn round on repairs. No wonder Perkins Diesels are at work on 423 applications, in 143 different countries. Perkins service is world-wide too. Perkins Overseas Companies and distributors and the manufacturers who standardize on Perkins' engines, ensure that Perkins Service and spares are readily available.

THE L4 (I) POWER PACK. This industrial power pack forms an extremely versatile unit which can easily be moved or mounted on a large variety of plant. The L4 (I) engine of 53 B.H.P. at 1,800 r.p.m. although extremely robust is not heavy. Approximate Shipping Specifications: The complete Power Pack weighs 1,450 lbs. net, 1,700 lbs. gross. Dimensions 5'4"x4'10"x2'.

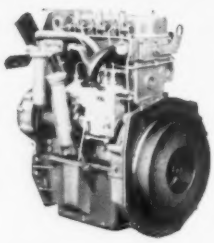
P6 (V) Automotive Diesel Engine



L4 (M) Marine Diesel Engine



P4 (I) Industrial Diesel Engine



P3 (TA) Tractor Diesel Engine

JOIN THE PERKINS DRIVERS CLUB

Full technical details of the Perkins range of diesel engines are available on request.

Perkins HIGH QUALITY DIESELS

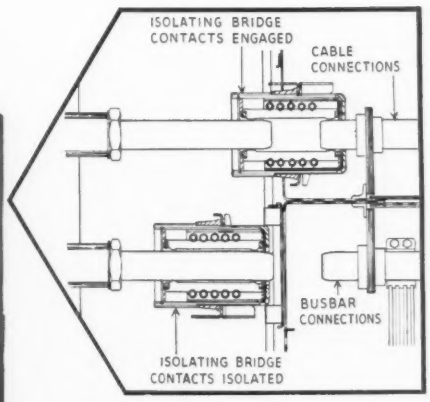
The Diesel Engine with the clean exhaust

FOR INDUSTRIAL, VEHICLE, AGRICULTURAL AND MARINE APPLICATIONS

F. PERKINS LTD., PETERBOROUGH Phone: Peterborough 5341

Air-break switchgear for process plant control

incorporating 'ISOLECTOR'



'ENGLISH ELECTRIC' Class 'E' Air-break Switchgear incorporating 'Isolector' represents a great advance in switchgear practice.

With the 'Isolector' mechanism it is no longer necessary to withdraw the truck from the cubicle to isolate the breaker. Isolation facilities, together with the cable earthing switch fitted to each unit, are all readily operated from the fool-proof interlocking gate at the front of the unit.

The 'Isolector' mechanism simplifies busbar selection in duplicate busbar units. These are available in the same cubicle dimensions as single busbar units.

A mimic diagram provides *mechanical* circuit indication and is clearly visible with the door open or closed.

The ratings for Class 'E' Switchgear are: Breaking Capacity - 150 MVA at 3.3 kV, Maximum service voltage - 3,300 volts, Maximum current rating - 2,000 amps. The gear is housed in a handsome, dust-proof cubicle and has excellent main and multi-core cabling facilities.

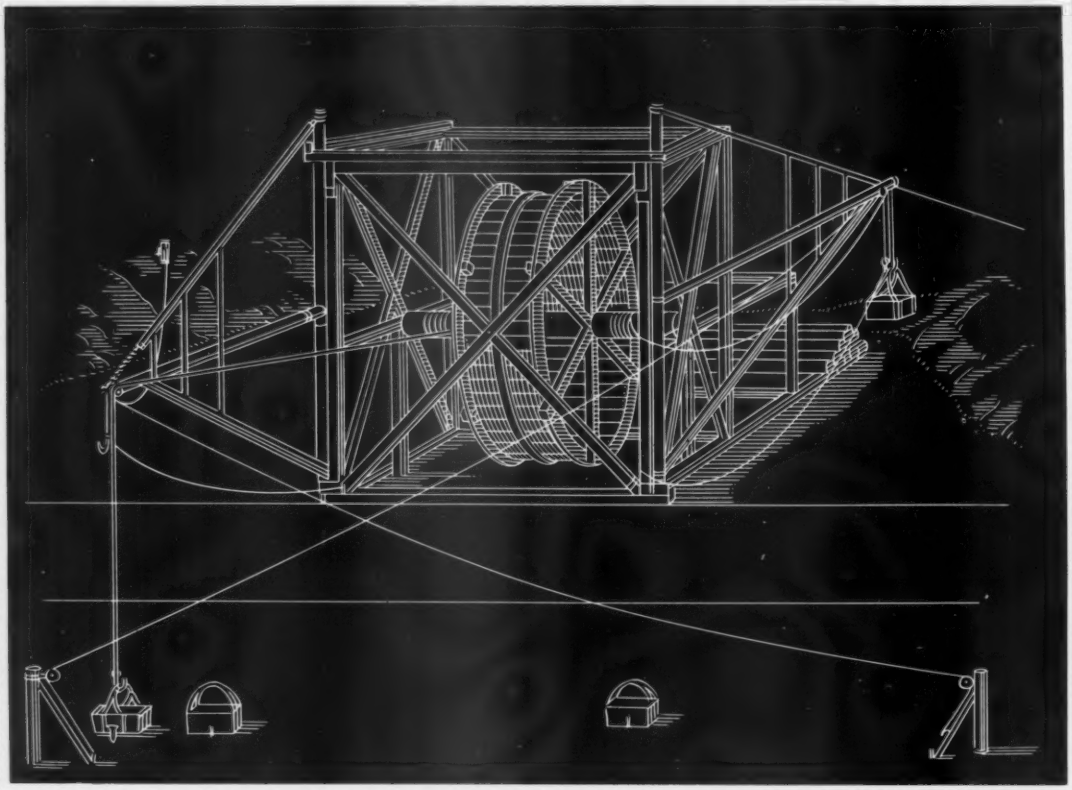
'ENGLISH ELECTRIC'

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

Switchgear Department, Liverpool

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

SCL.23 B



From a Science Museum Photograph

Five centuries of digging for treasure

More than 450 years ago Leonardo da Vinci was solving problems which would still have to be met in an age much later and much more developed than his own. His drawing for a drag-line scraper makes it clear that the principles of large-scale excavation, and the methods of solving its problems, have not changed very much since he was working on them. But the potentialities of his designs were frustrated by the lack of sources of power more adequate than water, muscle or the pull of gravity. With the advent of modern sources of power, and the discovery and exploitation of the treasures of the earth, man can appreciate the full value of Leonardo's plans. 250 years after Leonardo's death man began to utilise the power that lies in coal, and another 100 years later the immense possibilities of mineral oil for power and lubrication were discovered. Vacuum Oil Company — now Mobil Oil Company — was founded in 1866, only seven years after the sinking of the first commercial oil well. During the succeeding 90 years the company has pioneered many of the technological advances that have made Leonardo da Vinci's dreams into modern commonplace. Today, Mobil products are known and used throughout the world, setting the standard of quality for products of their kind.

Mobil

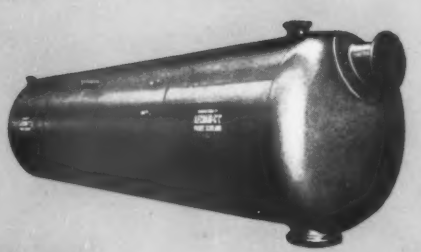
MOBIL OIL COMPANY LIMITED, LONDON S.W.1

PRESSURE VESSELS

Illustration (left), shows a mild steel Disengaging Drum 12 ft. internal dia. by 40 ft. long overall, leaving the makers' works in Paisley for Esso Petroleum Co.'s Refinery at Fawley.

The dead weight of the drum is 23 tons.

It was designed and constructed in accordance with the API-ASME Code for Unfired Pressure Vessels. The welded seams were completely radiographed.



CRAIG

CRAIG
comprehensive service

- Design and manufacture of Heat Exchangers
- Fractionating Columns
- Strippers
- Receivers
- Tanks, etc.,

in a variety of metals including stainless steel, stainless clad and alloy steels.

A. F. CRAIG & CO., LTD.
CALEDONIA ENGINEERING WORKS
PAISLEY · SCOTLAND
LONDON OFFICE: 727 SALISBURY HOUSE
LONDON WALL, E.C.2
PHONE: **NAT**IONAL **3964**

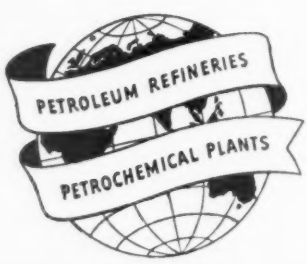
Wrong Place to Cut Costs of a New Process Plant

When building a new process plant, engineering is the easiest place to cut investment costs. But it's the wrong place! The saving of a few hundred hours of engineering, or trying to buy engineering at a price, can cost thousands of extra hours of field labour and additional thousands of pounds for materials. Although the added cost of inadequate engineering seldom can be pin-pointed beforehand, it is inevitably reflected in the operating record of the plant. Better engineering is the basis of the Kellogg organisation's world-wide reputation both as engineers and builders of complete process plants and as consultants on various special engineering projects. This better engineering is the result of good engineers working in an atmosphere where sound engineering is the measure of success for both the individual and the organisation. To Kellogg's clients, better engineering means plants built at the lowest capital investment consistent with reasonable operating and maintenance costs. Kellogg International Corporation welcomes the opportunity to demonstrate how better engineering can benefit companies contemplating new process plants.

Kellogg International Corporation

KELLOGG HOUSE CHANDOS STREET. CAVENDISH SQ. LONDON · W.1.

SOCIETE KELLOGG · PARIS
THE CANADIAN KELLOGG COMPANY LTD · TORONTO
KELLOGG PAN AMERICAN CORPORATION · NEW YORK
COMPANHIA KELLOGG BRASILEIRA · RIO DE JANEIRO
COMPANIA KELLOGG DE VENEZUELA · CARACAS



Subsidiaries of

THE M. W. KELLOGG COMPANY

NEW YORK

Paramins

HAVE REVOLUTIONISED OIL PERFORMANCE

THIS IS THE RANGE OF

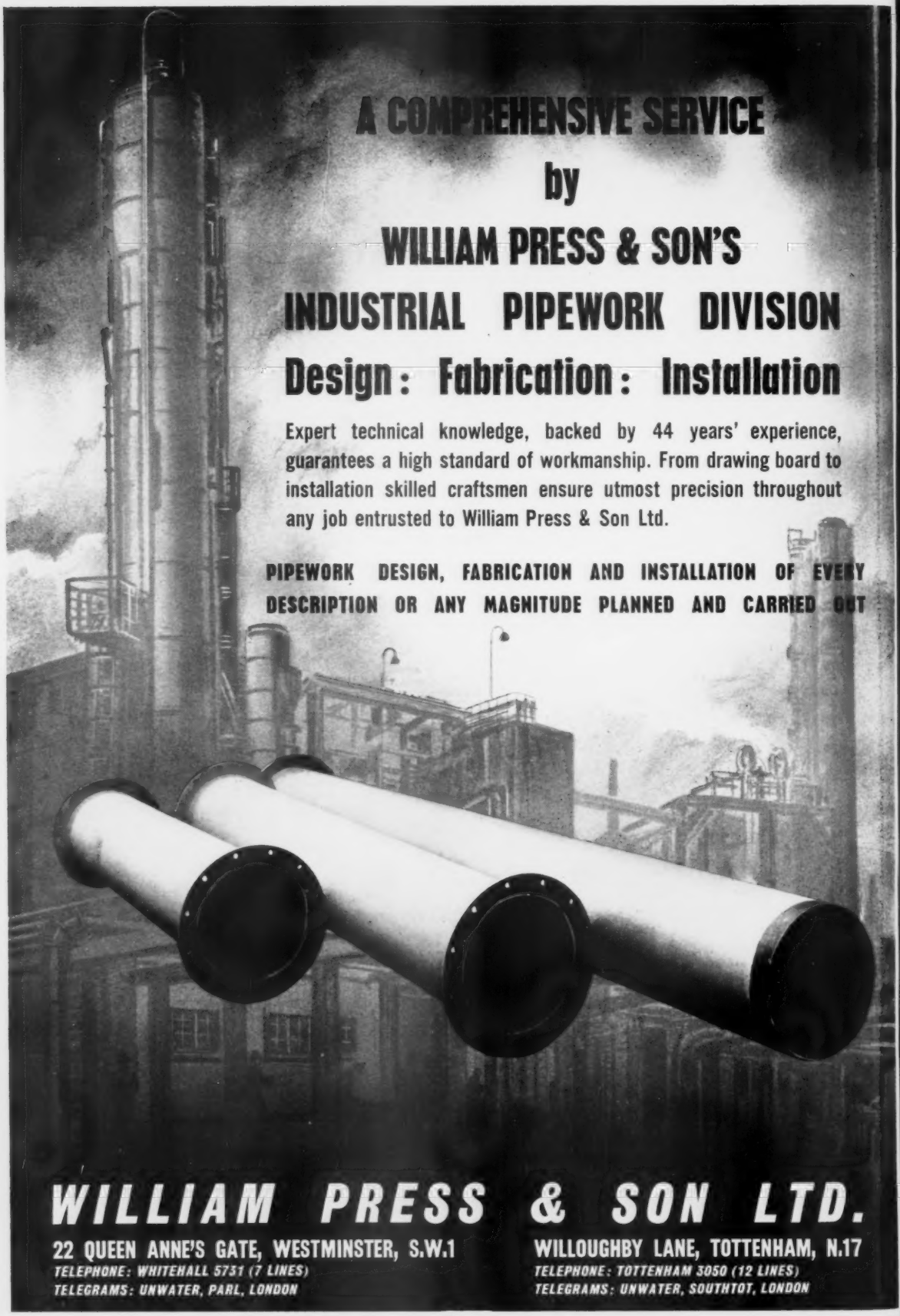
PARAMINS

TRADE MARK

- ***PARABAR*** — anti-oxidants and rust-inhibitors
- ***PARAFLOW*** — pour point depressants
- ***PARATONE*** — viscosity index improvers
- ***PARANOX*** — detergent-inhibitors
- ***PARATAC*** — tackiness agent
- ***PARASHEEN*** — cast modifier
- ***VISTONE*** — oiliness agent

Modern machinery is always making new demands on oils. Paramins developed in the world's largest petroleum research laboratories, have continuously enabled oil to meet these new demands. Our representative will be pleased to call with full information.

ESSO PETROLEUM COMPANY, LIMITED · 36 QUEEN ANNE'S GATE · LONDON · SW1



A COMPREHENSIVE SERVICE
by
WILLIAM PRESS & SON'S
INDUSTRIAL PIPEWORK DIVISION
Design : Fabrication : Installation

Expert technical knowledge, backed by 44 years' experience, guarantees a high standard of workmanship. From drawing board to installation skilled craftsmen ensure utmost precision throughout any job entrusted to William Press & Son Ltd.

PIPEWORK DESIGN, FABRICATION AND INSTALLATION OF EVERY DESCRIPTION OR ANY MAGNITUDE PLANNED AND CARRIED OUT

WILLIAM PRESS & SON LTD.

22 QUEEN ANNE'S GATE, WESTMINSTER, S.W.1
TELEPHONE: WHITEHALL 5731 (7 LINES)
TELEGRAMS: UNWATER, PARL, LONDON

WILLOUGHBY LANE, TOTTENHAM, N.17
TELEPHONE: TOTTENHAM 3050 (12 LINES)
TELEGRAMS: UNWATER, SOUTHTOT, LONDON

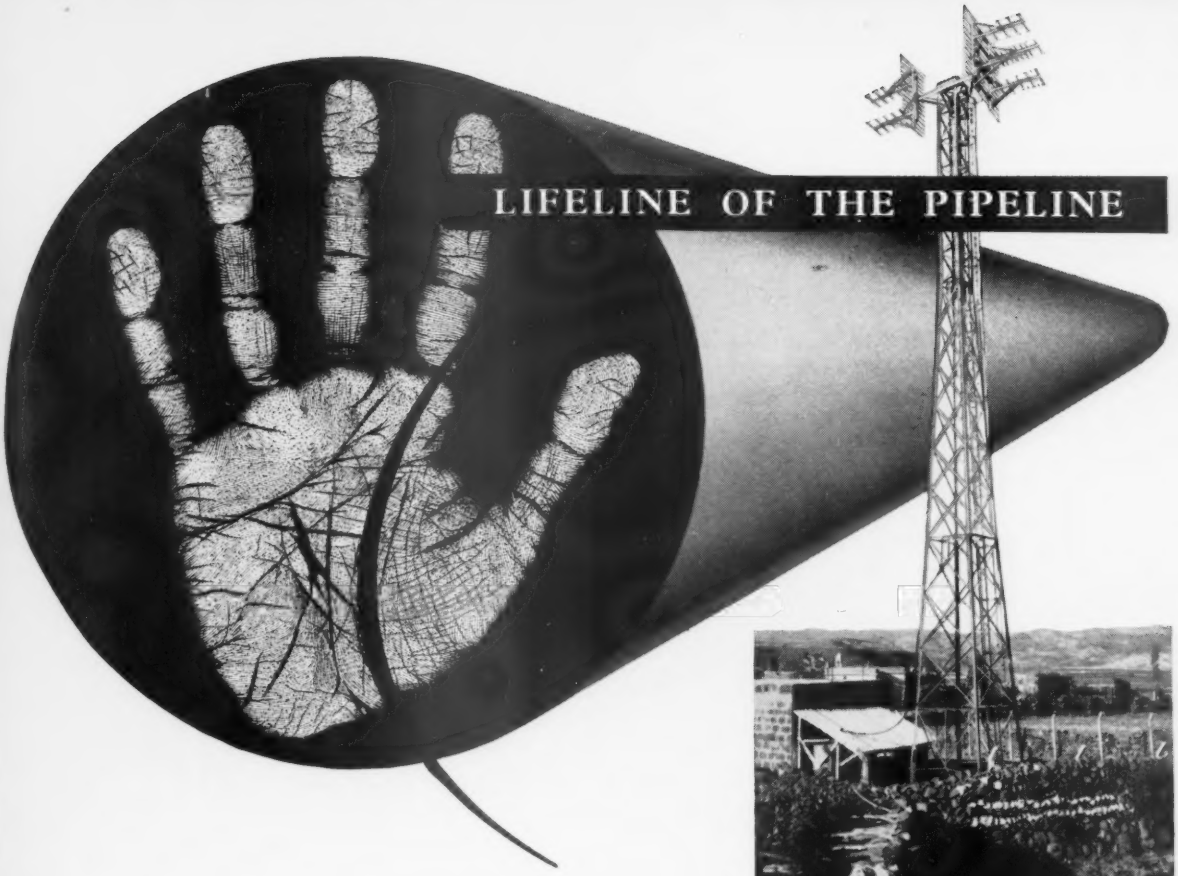
Mar

Re
mu
fo
tel
mu
ter

un
du
wh

co
co

MA

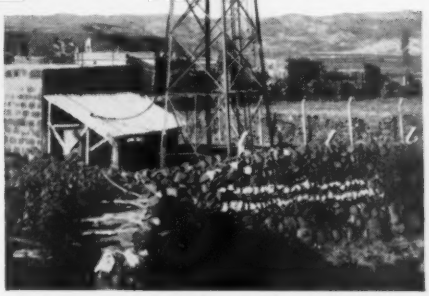


Marconi's hand in Communications for the Oil Industry

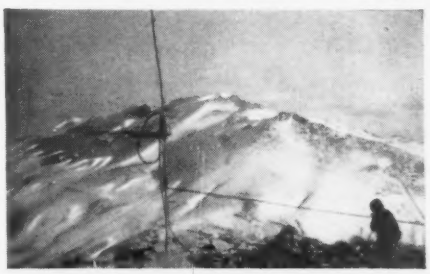
Reliable communications are the lifeline of a pipeline. Marconi VHF multi-channel systems are meeting all the requirements of oil companies for point-to-point networks. One system can handle all the traffic of telephone and teleprinter, tanker loading installations and mobile communications with vehicles and craft. Line systems can be linked with terminal equipment when required.

Both radio and power plant are designed for prolonged, fully automatic, unattended operation. Automatic fault alarms and change-over to duplicated systems provide warning of faults and uninterrupted service while they are being rectified.

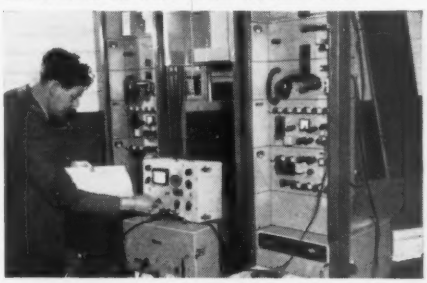
VHF systems are as clear and reliable as landline or cable and they cost very much less to instal and maintain, particularly over difficult country.



A repeater station installed at Dahr Safra for the Iraq Petroleum Company. Duplicated power supply and automatic changeover facilities ensure uninterrupted service in 4 channel VHF link stations of this type.



A Marconi survey engineer tests for signal strengths at a lonely mountain site during the radio-propagation survey along the trans-Iranian pipeline route.



Development work at Chelmsford on HM 181 VHF multi-channel equipment. Eighty-four of these will be supplied for the trans-Iranian scheme.

MARCONI

COMPLETE COMMUNICATION SYSTEMS

Surveyed, planned, installed, maintained

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX

LC 19

SPECIAL-PURPOSE REFINERY UNITS
The world-wide Fraser Contracting Organisation offers a complete service for the design and construction of special purpose petroleum refinery plant. Recent examples include the Solvents Distillation Unit at ESSO Ocean Terminal, Purfleet, Essex (illustrated), the Autofining Plants at Llandarcy and Aden and The Platformate Splitter Units at Llandarcy and Isle of Grain, for the British Petroleum Co. Ltd.
DEVELOPMENT • DESIGN • ENGINEERING • FABRICATION • PURCHASING
EXPEDITING • INSPECTION • ERECTION • COMMISSIONING
COMPLETE ENGINEERING BY
W.J. FRASER & CO. LTD.
Romford, Essex & Barnsley, Yorks.
Australia · New Zealand · Rhodesia · S. Africa · Spain

TAS/PS. 489

THE INSTITUTE OF PETROLEUM
REVIEW

Volume 11, No. 130 October 1957

Honorary Editor: E. B. EVANS, M.Sc., PH.D., F.R.I.C. *Hon. Associate Editor:* D. L. SAMUEL, B.Sc., A.R.I.C. *Editor:* GEORGE SELL

*Oil Firing**

By G. J. GOLLIN (Fellow)†

It is necessary to know something of the properties of liquid fuels in order to understand the science of oil burning. Although oil burning can with justice claim to be regarded as a science there are still wide sectors which remain to be more thoroughly explored and hence to a certain extent the practice may be still regarded as an art rather than a science.

In Britain there are four main grades of liquid fuels—domestic, light industrial, heavy industrial, and extra heavy fuel. The first differs from the other three in appearance and in many other characteristics. It alone is a distillate. Although it has been present in the crude oil, it can be regarded as a manufactured fuel since at one stage of its preparation it has been in the vapour state. Great care has been devoted to its preparation and it must conform to a rigid specification drawn up to make the fuel suited for the particular purposes for which it is used. An oil merchant might regard this light fuel and the extra heavy fuel oil as his basic stock. Given these, one could satisfy a market with them together with one or two intermediate blends which would consist of the two basic liquids blended in suitable proportions.

The properties of liquid fuels exert a strong influence on the design and application of various burner systems. These properties can be briefly described.

Properties

Specific Gravity

It is only necessary to know this and how it varies with temperature if fuel is bought by volume, *i.e.* by the gallon, and calculations by weight, such as, the contents of a storage tank or the efficiency of a boiler or furnace have to be made.

Calorific Value

To the user, the knowledge of calorific value is essential. It is customary in Britain to use the gross calorific value, *i.e.* the heat obtainable from the combustion of the unit weight of fuel if the products of combustion were cooled to 60° F and the water vapour condensed. The latter condition is rarely obtainable in practice but it does apply to the heating of a vessel containing liquid by passing the products of combustion through the liquid. For all normal uses, the products of combustion leave the system with the water still in the vapour state and hence the maximum utilizable heat is about 1100 B.t.u/lb less than the gross calorific value.

When a gallon of oil is burned rather more than a gallon of water is formed. There have been cases where it has been found that on lighting up an oil burner several gallons of water flow down the inside of the, as yet, unheated metal stack. The user has been known to jump to the conclusion that the supplier has delivered contaminated fuel. The explanation is that the fuel contains between 11 and 13 per cent of hydrogen by weight and this in burning forms nine times its weight of water.

British engineers are apt to be rather sceptical regarding the claims made in some European countries regarding boiler efficiencies. However, it should be remembered that normally on the Continent the net calorific value is used in such calculations and when measuring the stack loss the steam or hydrogen loss is omitted. Thus, by the Continental method a maximum efficiency of 100 per cent could be obtained, while by the British method the maximum efficiency on liquid fuel lies between 93 and 94 per cent. Therefore, in considering a report on a Continental boiler test which results in an efficiency of, say, 92 per cent, it is safe to assume that by British standards the efficiency would be about 86 per cent. The Continental method tends to minimize the difference between solid and liquid fuels, the latter having only about half the hydrogen content and therefore will only suffer half the steam loss in the exit gases.

Flash-point

This has negligible effect on burning qualities, but concerns safety in storage. If the flash-point is below 150° F then certain safety precautions must be adopted. This point does not arise in connexion with industrial liquid fuels, since their flash-point is well above 150° F. Many people think that the flash-point is the temperature at which the fuel might catch fire. This is not so. It is the temperature at which, in certain standardized laboratory apparatus, the surface of the fuel

*Based on a paper read before a Joint Meeting of the IP Stanlow Branch and the Institute of Fuel.

†Shell Petroleum Co. Ltd.

will give off sufficient vapour to ignite at the application of a naked flame. What these people have in mind is the spontaneous ignition temperature which is several hundred degrees higher.

Viscosity

From the handling and burning point of view, viscosity is the most important property of the fuel. As it is very difficult to ignite liquid fuel in bulk, the most important function of the burner is to split up the fuel into a vast number of small drops. This can only be achieved if the viscosity of the liquid is low enough. Fortunately the viscosity of oil fuels decreases with rising temperature. Fig 1 shows the relationship for the grades commonly sold in Britain, and it shows that for the heavier grades the viscosity is roughly halved for every temperature rise of 25° F. Most oils must therefore be heated in order to facilitate atomization. Also, in order to economize in power to move the fuel from one place to another, it is advisable to keep the viscosity of the fuel in transit to less than 3000 sec Redwood No. I. Fuels of higher viscosities require high pressures and large pipes for transit.

A third reason for keeping a fuel warm and hence sufficiently fluid is to enable it to flow under atmospheric pressure and static head from the storage tank to the transit pump. This it could not do if its viscosity became too high and it formed a jelly-like structure.

Pour Point

This is the temperature at which, under standardized laboratory conditions, the fuel in a test tube ceases to flow. Some oils at low temperatures assume the properties of a jelly, perhaps due to petroleum wax crystallizing out. While such wax is a normal constituent of a fuel and is itself an excellent fuel, it can be embarrassing at low temperatures. When it appears as crystals it can influence the viscosity of the oil so that it no longer is dependent solely on the temperature but may also depend on how fast the fluid is moving. In such a state, the slower the movement, the more resistant to movement the fluids become. This interesting property affects the temperature at which to keep heavy grades when in storage and also the type of heating gear which should be selected.

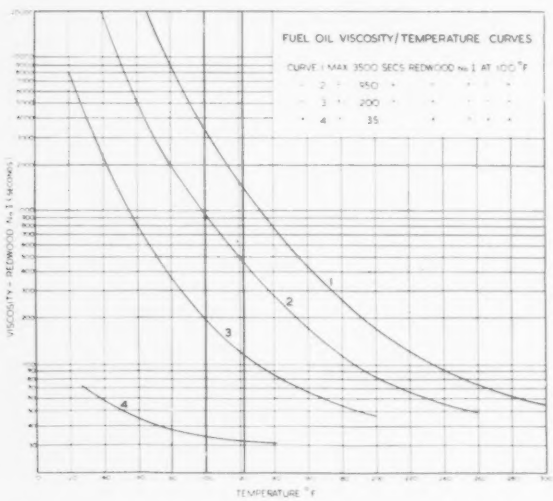


Fig 1.

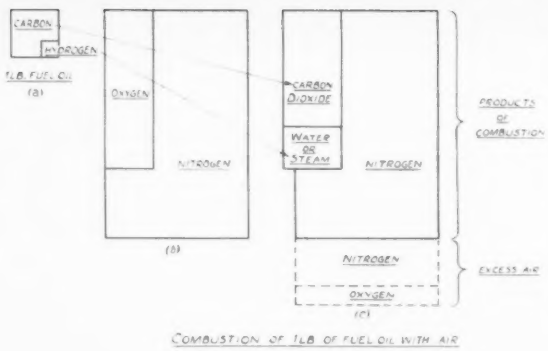


Fig 2.

Ash

There are to-day boiler installations being fired with solid fuel which contains 30 per cent ash, or even more. In contrast, it is only rarely that a liquid fuel has an ash content exceeding 0·5 per cent. In spite of this, in a 60 mW or 240 ton/hour boiler, such as in power stations, the fuel burned will be as much as 15 tons/hour and this, if the ash content is only 0·2 per cent, is equivalent to introducing 70 lb/hr of ash. If only a quarter of this sticks to the boiler surface, it can cover a large area with a thin coating. Such a coating can give rise to problems with superheater tubes or hangers in those cases where the steam is being superheated to above 1000° F. Fuel oil ash can also cause difficulties when it adheres to the blades of gas turbines.

Combustion of Liquid Fuels

Petroleum liquid fuels contain by weight some 11·5 per cent hydrogen and 85 per cent carbon. Each pound of fuel requires 0·9 lb of oxygen for the combustion of hydrogen and 2·25 lb of oxygen for the combustion of the carbon. The total oxygen, *i.e.* 3·15 lb, is obtained from about 14 lb of air, or approximately 180 cu. ft. It is advisable to keep this in mind because the average room of capacity 2000 cu. ft. contains only enough air for the complete combustion of 1 gallon of oil. In practice the average oil burner cannot be made to work satisfactorily without some 30 per cent excess air, so that when formulating schemes it is advisable to allow 240 to 270 cu. ft. of air for each lb of oil to be burned. Fig 2 shows the constituents of the fuel, the products of combustion, and the unchanged excess air. Air is a most expensive commodity to burn. It diminishes the usable value of the fuel in two ways. First, by reducing the mean combustion chamber temperature and hence the radiating power of the flame, which is one of the most valuable properties of liquid fuel. Secondly, the excess air passes through the furnace and, on leaving, takes with it, in the form of sensible heat, a large proportion of the calorific value of the fuel. This can be appreciated by considering a whisky and soda where the whisky is the expensive component and the soda the comparatively cheap. Too much soda can ruin the value of the whisky just as diluting the products of combustion can ruin the performance of an oil flame.

The simile can be extended to demonstrate the use of the CO_2 content as an indicator of the amount of excess air present. Given a statutory nip of whisky in a glass one can calculate the amount of excess soda by ascertaining the proportion of the whisky in the mixture. So by absorbing the CO_2, its fraction of the dry flue gases can be measured

and the amount of excess air present deduced. The relationship is:—

$$\text{Excess air } \% = 94\left(\frac{\text{CO}_2 \text{ theoretical}}{\text{CO}_2 \text{ actual}} - 1\right)$$

The theoretical CO_2 for most liquid petroleum fuels lies between 15·5 and 16 per cent so that a rough rule is:—

$$\text{Excess air } \% = 100\left(\frac{16}{\text{measured CO}_2} - 1\right)$$

Thus 10 per cent CO_2 would be equivalent to 60 per cent excess air.

Slide rules and charts are available to relieve the engineer of the necessity of doing these mental calculations.

Smoke

Before the war a reasonable standard of combustion was regarded as 11 per cent CO_2, *i.e.* about 40 per cent excess air and no smoke visible at the stack. The last point was rather nebulous, because the observance of smoke depends greatly on the colour of the sky and to a certain extent on the strength of the wind. The development of the portable electric smoke meter has enabled the quality of combustion to be examined in much greater detail. The instrument sucks a small quantity of gas through a disk of filter paper for a period of 1 minute and the resultant stain is compared with the standard chart of 10 smoke shades. The first six of these are equivalent to clear stack conditions but give a good indication of the quality of combustion. For any given burner installation, the burners can be operated with varying amounts of excess air and, for each, a smoke number measured. It is then possible to draw a curve connecting CO_2 and smoke number, as shown in Fig 3. The middle curve can be regarded as acceptable performance, the upper one as unsatisfactory, and the lower very good. The question is often asked as to how to tell the difference between a good and a bad oil burner. A smoke-CO_2 curve would appear to be the answer.

Oil Burning Systems

Fig 4 shows the various branches of the oil burner family. There is an impression that the existence of so many types of oil burners is a symptom of commercial competition.

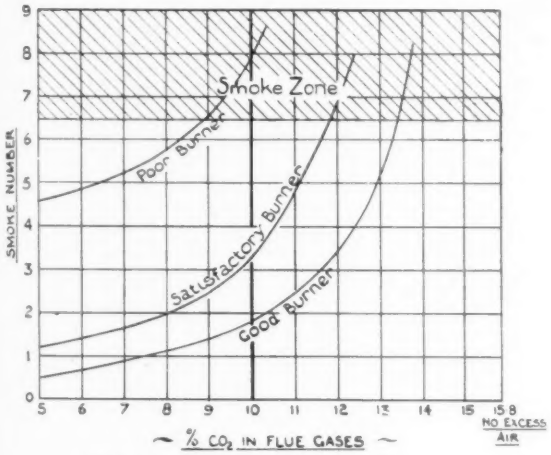


Fig 3. *Assessment of burner performance.*

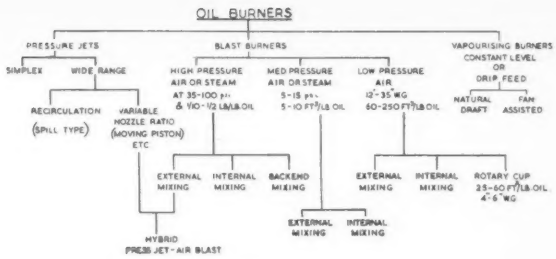


Fig 4. *Oil burner types.*

This is not true. The variations have been developed to meet the individual requirements of steam raising and furnace applications.

Liquid fuels in bulk are difficult to ignite and their satisfactory combustion depends on the choice of the correct type of burner for each application.

The functions of a burner are six:—

1. *To split up the fuel into a vast number of small particles.*

This has two effects; first to present a large surface of oil to the air containing the oxygen; and, secondly, to enable an adequate amount of vapour to be stripped off the droplets in the fraction of a second between the time when the droplet leaves the burner nozzle and the time when it enters the flame front.

2. *To introduce the air for combustion.*

Many users and a few burner manufacturers tend to forget the 20 lb of air needed to burn each lb of oil.

3. *To form a stable flame front.*
4. *To mix the air with the fuel* (in the right proportions at the right stages).
5. *To form a flame of the desired shape.*

Where the combustion chamber cannot be made to suit the flame, the flame must suit the combustion chamber. The position of the burner and the shape of the flame must be such as to avoid the flame touching the walls. If this occurs in a hot combustion chamber, *i.e.* one lined with refractory, damage may be done to the refractory due to the increased heat transfer factor at the point of contact. Secondly, the temperature of the refractory, being still appreciably cooler than the flame, may quench combustion and cause a deposit of carbon representing incompletely burned oil at the point of impingement. In a combustion chamber with cool walls, such as a flame tube surrounded by water, it is very important to avoid impingement to prevent carbon formation and even possibility of damage to the metal wall.

6. *To complete combustion within the permissible time and space.*

A droplet of liquid fuel probably takes between 0·1 and 0·2 second to burn. The path of the droplet and the incidence and direction of the air flow must be designed to keep the flame within the combustion chamber and to avoid incomplete combustion and possible damage to the appliance or product heated.

Blast Burners

These utilize a stream of air, steam, or even combustible gas which either converges on a stream of fuel outside the nose of the burner, in which case the burner is known as an external mixer, or picks up or froths the fuel inside the burner either at the rear end or at the exit end.

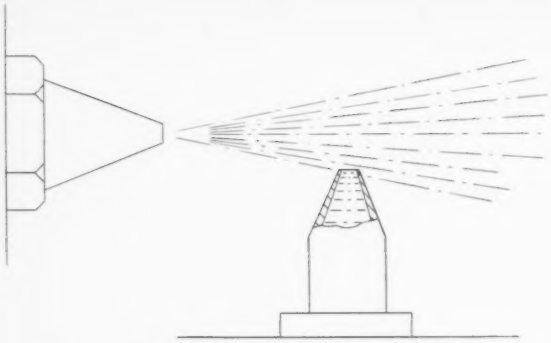


Fig 5. Simple blast burner.

The atomizing medium may be at 10 psi, 30 psi, or 100 psi. From $\frac{1}{3}$ to $\frac{1}{2}$ lb of steam or air is used per lb of oil. In internally mixing burners, the atomizing medium has to pick up the fuel inside the burner and hence the mixture of fuel and air or steam leaves the nose at lower speeds than those mentioned.

The simplest blast burner is the scent spray type (Fig 5) and one of the earliest variations is the Mexican trough burner in which the fuel flows slowly over a weir while under the lip of the weir a fast moving ribbon of steam picks it up and atomizes it. In the process, the steam first tears the oil into short fine threads which later, under the influence of surface tension and turbulence, break up into droplets. Such burners are still widely used in oil-fired steam locos.

Unless skilfully designed, the blast burner of the medium pressure or high pressure type tends to give a long narrow angled oil–air spray. This fast moving stream sucks into itself the air needed for combustion. This it does approximately according to the law that the sum of momentum of the injecting jet and that of the injected air remains constant. One can therefore calculate roughly the length of the flame or rather the point at which the flame may have picked up the air required theoretically for combustion. The distance will depend upon the amount of oil being burned and the density of the injecting stream and the momentum of that stream. The British Iron and Steel Research Association did some interesting research on this point.

As a rough approximation

$$\text{Flame Length} = \frac{\text{Weight of oil (lb/sec)} \cdot 1360}{\sqrt{\text{momentum flux of jet (lb ft/sec)}}}$$

If a burner is atomizing with 450 lb of compressed air, 100 gal/hr of oil, and the oil and air leave the nozzle at 400 ft/sec, then from the above formula the flame length might be about 28 ft.

In the low-pressure air burner using air at 15 to 35 inches W.G. the air velocities are low, being of the order of 250 to 360 ft/sec. To provide enough momentum a large proportion, from 25 to 100 per cent, of combustion air is required. This results in large nozzles and brings the difficult problem as to how to ensure that each cubic foot of air from the fan will pick up its ration of oil. Different burners solve this with varying degrees of success but the spinning cup burner not only initiates atomization with the primary air but uses the cup to ensure homogeneous distribution of the oil across the relatively thin annular stream of atomizing air.

Figs 6–9 show, respectively, blast burners of the high pressure (6), medium pressure (7), low pressure (8), and low pressure-rotary cup types (9).

The medium and high pressure burners tend to have rather narrow flame angles, and this can be of great advantage. When properly designed and by giving a degree of swirl to the atomizing medium, the flame angle can be enlarged. The rotary cup burner can be fitted with air nozzles to make the flame either long and narrow or short and bushy.

Too much attention is often focused on the burner or atomizer and insufficient on the air director or register. The two components are complementary and perhaps the latter is the more important. It usually consists of two parts. The first part is made of metal and is used to control the quantity and direction of the incoming air. This air can be introduced in three ways:—

(*a*) By the natural draught set up by the hot chimney;
(*b*) By the chimney draught assisted by an induced draught fan;
(*c*) By natural draught assisted by a forced draught fan;
(*d*) By a forced draught fan and an induced draught fan giving virtually atmospheric pressure in the combustion chamber.

The second part of the air register consists of the refractory quarl bricks and this should be regarded as an essential part of the air register. The quarl plays three important functions:—

1. To provide a hot zone around the root of the flame in its nursery stage;
2. To keep the incoming air in close proximity to the oil spray and primary air stream. This is of great importance because once the flame is fully established and full flame temperature reached, not only will the incoming air be six times more dense than the flame but its viscosity will be twenty times less than that of the hot products of combustion and so the two are very difficult to mix thoroughly with each other. It is seldom appreciated that the kinematic viscosity of nitrogen at 1500 C is about 300 cS, which is equivalent to 1200 sec Redwood I, the viscosity of a heavy fuel oil. Therefore, to get good mixing one must introduce the air at an early stage into the flame or it may be too late;
3. To mould the flame to the requisite shape and included angle.

The average blast burner is not very sensitive to the direction or velocity of the incoming combustion air provided that it is introduced symmetrically around the flame and the quantity is under control. Blast burners have given good combustion conditions when the pressure drop across the register has been only $\frac{1}{8}$ inch W.G., *i.e.* equivalent to a velocity of only 23 ft/sec, the narrow-angled flame sucking in the combustion air into the primary air-fuel jet.

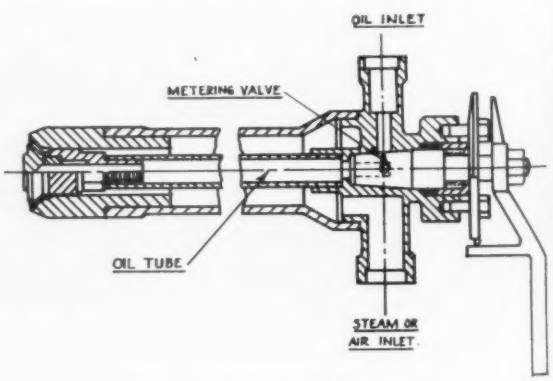


Fig 6. High pressure blast burner.

The primary air–fuel jet itself establishes a flame form, usually candle-like in shape, and this is especially suited for use in narrow combustion spaces.

A useful type of blast burner is that which has a rather dubious claim to the title of burner since, in a cold combustion chamber, it can be lit on the application of a torch but will be immediately extinguished if the torch is withdrawn. Such burners seem only to function satisfactorily when the combustion chamber is at a temperature of 600° C or above. At one time their flame instability was attributed to coarse atomization, but investigations in connexion with the work of the International Flame Research Committee revealed that these injectors, as they should more correctly be termed, produce a finely atomized and fairly homogeneous spray.

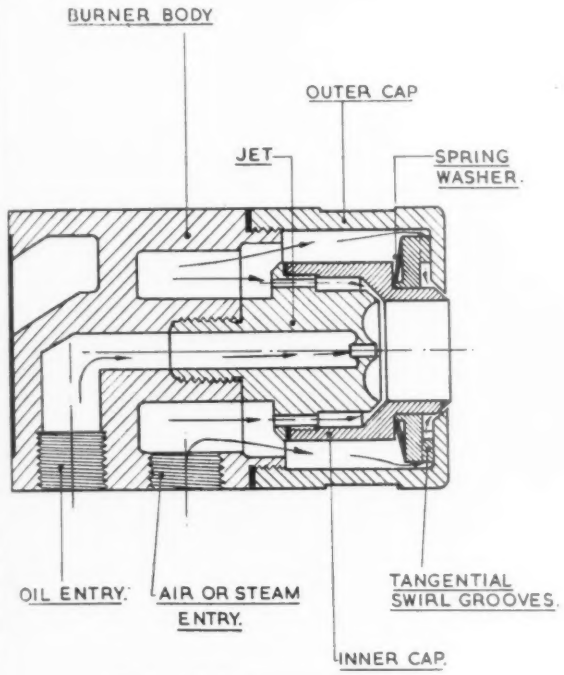


Fig 7. *Medium pressure blast burner.*

To keep a flame alight three things are essential:—

(*a*) A region of low velocity;
(*b*) A reasonable quantity of oil vapour stripped from the surface of the oil droplets;
(*c*) An air–fuel ratio which does not greatly exceed twice the stoichiometric ratio.

In the narrow-angled high initial velocity sprays produced by these injectors, for the first two or three feet in front of the burner nose the spray velocity may average several hundred feet per second. In the very short time between the droplet leaving the nozzle and covering this distance, insufficient vapour is stripped from the droplet by the small radiating flame front while the high-speed jet rapidly induces air into itself. So nowhere is a burnable self-supporting mixture available until the temperature of the furnace is raised by independent means to supply that vaporizing agency to strip the light fractions from the droplets and to raise the temperature above the spontaneous ignition point of fuel.

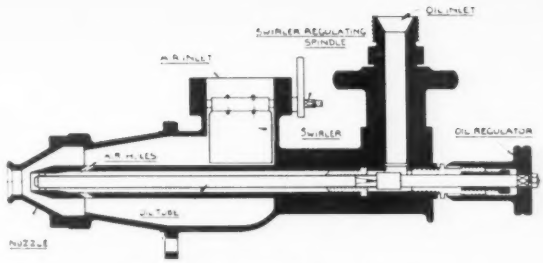


Fig 8. *Low pressure blast burner.*

These injectors should not be despised since they are of great value in the long narrow combustion chambers which flank the muffles of ceramic tunnel kilns. Their widest use is in the combustion space of open hearth furnaces where, in spite of an ambient temperature of 1600°–1700° C, they launch their flames of 300 and 500 gallons per hour down 20 to 30 feet of the furnace, where an orthodox burner would release far too much of the fuel's energy at the burner's point of application.

Pressure Jet Burners

It is possible that to the sea-going engineer this is the only type of burner worthy of consideration and for marine use it has many important advantages. At sea an adequate staff is always available who would not feel insulted if asked to remove and clean the atomizers every eight hours. Also, at sea the load tends to be steady hour by hour, if not day by day. The ability to control the behaviour of several dozen burners simultaneously from one point has attractions for the ship's boiler room as it still does for the land power station. Nevertheless the development of oil burning ashore has to a large extent been carried out by men associated with its use at sea and to some extent the influence of marine practice on land oil-firing has not been an altogether beneficial one.

Nearly every oil-fired steamer afloat uses pressure jet burners. It should be clearly understood that the nozzle or atomizer by itself is not a burner in its own right when divorced from its air register. It is merely a means of

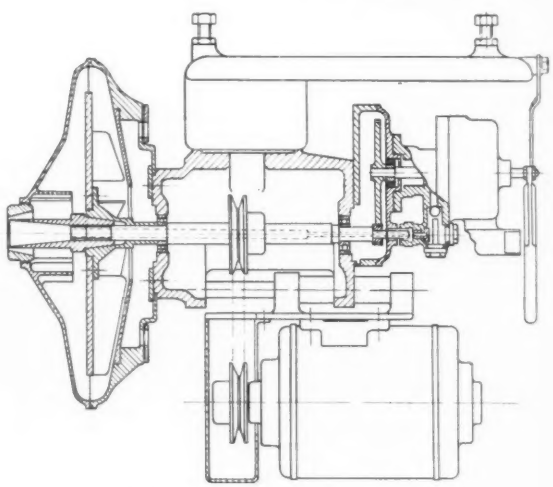


Fig 9. *Motor-driven rotary cup burner.*

obtaining a cloud of small droplets of diameter, say, from 0·125 to 0·25 mm. At the nozzle the spray will have a definite form but a few feet away the spray becomes a shapeless drifting cloud. A small droplet cannot for long maintain an initial velocity and will rapidly settle down to the velocity and direction of the ambient air currents. The function of the pressure jet air register is to force air across the stream of droplets while they have intrinsic motion and then to mould the flame. It must also act as a stabilizing influence since if a column of combustion air at 20 ft/sec to 30 ft/sec is directed along the axis of the pressure jet it will blow the flame away from the nozzle and extinguish it.

The stabilizing influence of the air register can be obtained in three ways:—

(*a*) From the ignition zone influence of the very hot quarl surface;
(*b*) From the slow motion zone or even return eddy zone created downstream of diffuser disks which act as windbreaks;
(*c*) From the low-pressure zones created in front of the atomizer by high energy rotation of the incoming air. This pressure distribution can link with the main circulation set up by the register, a secondary circulation tending to bring hot products of combustion backwards towards the burner nose. These currents can, by the intensity of heat transfer by convection to very small droplets, act as a more powerful agent in the stripping of vapour from the droplets than even the radiation backwards from the flame front.

The atomizer itself, if of the simplex type, is a curious appliance and the mathematical analysis of its method of operation is extremely difficult. Nevertheless its habits are fairly well known by now, thanks largely to the research done in connexion with aero-gas turbines during the war when nozzles were required to burn some 20 gal/hour in small metal combustion chambers some 9 inches in diameter and 18 inches long.

The simplex pressure jet (Fig 10):—

1. Unlike a plain orifice, while atomizing, passes less fluid as the fluid becomes thinner. The oil leaves the orifice in the form of a hollow rotating column possessing both rotational and translational energy. If the fluid becomes less viscous, its rotational energy increases at the expense of its translational energy and it passes less fuel;

2. Its angle of spray increases as the fluid becomes less viscous;

3. The output varies as the square root of the pressure, *i.e.* it is necessary to increase the atomizing pressure from 100 to 400 psi to double the throughput;

4. The mean droplet size varies directly as the one-fifth power of the output and the one-fifth power of the viscosity, and inversely as the cube root of the atomizing pressure. It would be a mistake to dismiss the pressure factor, because it would be necessary to increase the atomizing pressure from 100 to 800 psi to halve the mean droplet size. The time of burning may depend more on the droplet surface or its weight than on its diameter, and hence the use of high atomizing pressures may be justified, as the energy required is small and the employment of atomizing pressures up to 1000 psi may be rewarding when compelled to burn two tons of fuel per burner per hour in the combustion chamber of a large water tube boiler within a max length of, say, 30 feet.

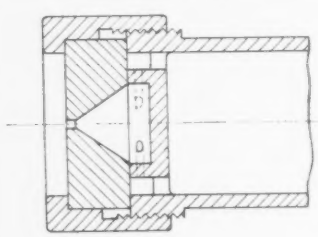


Fig 10. *Typical pressure jet nozzle.*

To overcome the small operating range of the simplex pressure jet burner a variety of wide range pressure jets have been developed. They can be divided into three groups, two of which are shown in Fig 11:—

(*a*) Those in which the configuration or dimensions of the swirl grooves can be altered while operating;
(*b*) Those in which some of the oil fed to the burner is sprayed into the combustion chamber and part is returned to pump suction;
(*c*) Those in which the nozzle is fed through several sets of independently controlled ducts.

There can be combinations of these systems. Some control the output merely by altering the atomizing or reflux oil pressure, while in other cases mechanical changes are obtained by hand or instrument manipulation. While the simplex pressure jet has a turn-down range rarely exceeding 2 : 1 without change of nozzle, when using the wide-range type, the range can be extended to 10 : 1 or even 20 : 1. By now the range of the atomizer has outstripped that of the air register and the performance of a pressure jet of any type is no better than that of its air register.

The normal air register has the quantity of combustion air controlled by sleeve, movable flange, or similar device at entry. This is also true of those air registers which control the ingress by a ring of articulated vanes. In all such registers, the quarl area remains constant and hence the velocity of the air entering the combustion chamber decreases in direct proportion to the oil input. It is doubtful whether any pressure jet register operates successfully with a pressure drop of less than 0·7 inches W.G. If this is the minimum permissible pressure drop at the low end of the burner range and is equivalent to an air velocity of 55 ft/sec, then, to maintain that velocity on a burner with 3:1 turn down range, the pressure at full load must be 6·3 inches W.G. It is satisfactory to note that pressures up to 8 inches W.G. are being employed for the forced draught in power station boilers, although the increased combustion efficiency may be partly offset by the increasing amount of power consumed by the auxiliary fans.

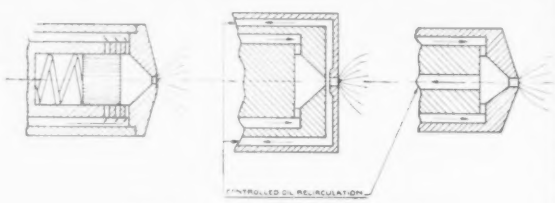


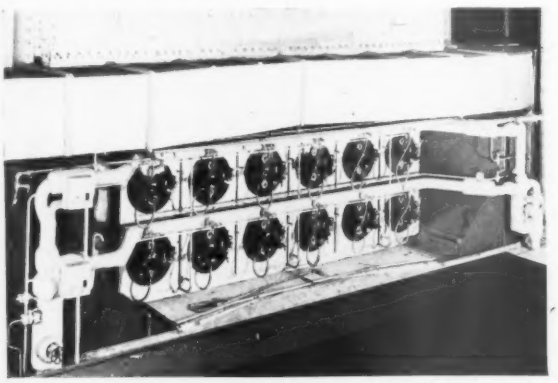
Fig 11. *Wide range pressure jets.*

For water tube boilers (Fig 12) the pressure jet is still the most widely used. In these the combustion chamber may have a mean temperature of 1500° C and over, and offers plenty of space in which to develop the flame. In these large chambers there must be a considerable amount of combustion gases recirculated into the flame. This slows down the flame and shortens it. As more burners are lit, the space for recirculation becomes less and the mean velocity of each flame increases and its length increases.

Hybrid Burners

Although the pressure jet is the orthodox burner for large water tube boilers, there are signs that its supremacy is being challenged by the modern steam jet which is usually of the hybrid type (Fig 13), *i.e.* employs oil pressure as well as steam or compressed air for atomization. These modern hybrid burners use for atomization less than 1 per cent of the steam generated and for large flames of 1 ton/hr or more about $\frac{1}{3}$ per cent. They have many advantages:—

1. They can operate over a wide range;
2. They produce a discrete flame shape which can be modified to suit the combustion chamber shape without impairing the quality of atomization;
3. They are less sensitive to air register velocity than simplex pressure jets;
4. It is not essential to reduce the viscosity of the fuel to the low value of 100 sec Redwood I required by the simplex and wide range pressure jets.



Courtesy Foster Wheeler Ltd.

Fig 12. *Pressure jet burner on water-tube boilers.*

Oil Burners for Shell Type Boilers

Before the war fuel prices were low and many users were complacent about fuel costs and wastage. Since the war, although fuel costs remain in many industries only a small percentage of the total manufacturing cost, the scarcity, control, and mounting price of fuels have compelled users to be much more careful and critical of the results obtained. Wise propaganda has fostered this attitude. The result is that many installations, especially those concerning shell type boilers, which might have passed muster in pre-war days are now unacceptable. Here the oil burner manufacturer deserves sympathy because the shell type boiler presents a formidable problem. The combustion chambers are water-cooled and often small in diameter. The rate of combustion is high, say, from 30 to 50 gal/hr in a 3-foot diameter flue some 10 feet long, *i.e.* 4 to 7 lb/cu. ft/hr. Combustion must therefore be completed in $\frac{1}{2}$ second. The flame rushes down the combustion tube at 20 to 30 ft/sec and if the fuel does not receive its air for combustion, it will partially vaporize and partially crack, causing dirty combustion. Here the simplex pressure jet with natural draught air register is at a distinct disadvantage. If the draught conditions will not produce 0·7 inch W.G. at the furnace front, the mixing will be poor and large quantities of excess air required to avoid making smoke. If large quantities of air are required, the friction through the boiler, varying as the square of the mass flow, will be high and, as the friction will be excessive, the draught at the boiler front low. This is a vicious circle only to be solved by the introduction of induced- or forced-

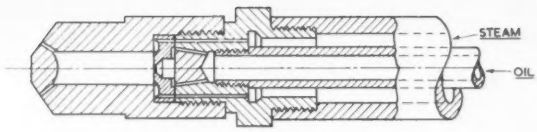


Fig 13. *Hybrid type burner.*

draught fans. For the brickset boiler the former is impracticable, as the high draught at exit to give 0·7 inch W.G. at the front tends in most cases to pull as much air through the setting as through the air register. Such stray air can play no useful part in flame formation and in fact impedes it by reducing the amount passed through the register.

A further trouble may be caused by the use of an air register which in a water tube boiler would stabilize the flame by aerodynamic means, *i.e.* by swirl. In the combustion chamber of the shell type boiler such swirl too frequently acts as a centrifuge, spinning a large proportion of the relatively heavy combustion air round the cold periphery of the combustion tube, from which position it cannot penetrate and mix with the core of hot flame in the centre. This gives a dark smoky centre to the flame which is hard to eradicate.

Frequently the velocity of the air through the register is too low to deflect the oil spray in time to prevent it from impinging on the cold wall of the flame tube, where it will form a ring of carbon and cause smoke formation even if large quantities of excess air are introduced. A pressure jet spray of 30 gal/hr capacity and 60° spray angle will hit the wall of the tube some 3 feet from the boiler front if no air is passing through the air register.

Several remedies can be tried to alleviate this too often found state of affairs:—

1. Nozzles of the best quality should be used and a check made that they really atomize efficiently at the available pressure;
2. An I.D. fan can be installed for an all metal boiler or a F.D. fan for a brickset boiler. The draught should be not less than 0·7 inch W.G. at the air register;
3. The air register should be designed to produce the narrow angled flame necessary for a 2 to 3 ft diameter flame tube;
4. The boiler should not be subjected to overloads;
5. It is inadvisable to operate the air register at a small fraction of its normal rating;
6. The quality of combustion should not be judged by the CO_2 alone. Use a smoke meter and try to keep the stack solids and smoke below a Smoke Number of 5 which means on the right side of Ringelmann No. 2.

For new boilers, careful consideration should be given before ordering the firing gear. The advice of a good burner maker is helpful. Most of them make several types of burners, blast burners as well as pressure jets. The wise burner maker will not attempt something difficult, if he makes and sells a type which makes the solution easy.

On the Continent, where in many countries the use of liquid fuel is the rule rather than the exception, in contrast with the situation in Britain up to now, the use of pressure jets for firing shell type boilers is exceptional, especially in those factories where the load fluctuates frequently and extensively. The low pressure air burner is often used with success, and the rotary cup type seems to be the most popular for this type of boiler. There is little to choose between the two variants of the same type of burner. In both, the most important items to watch are the method of introducing the secondary or combustion air and the method of metering the fuel. It needs skill in design to prevent the quantity of fuel flow from changing in conditions of changing temperature and hence viscosity and pressure. Here a "viscosity

valve" is useful, but the use of a controllable positive metering pump is rapidly coming to the fore.

Automatic Controls

These are roughly of three types:—

(a) *For fully automatic burners which work intermittently.*

The controls bring the burner into action and switch it off to maintain constant temperature or steam pressure. The controls guard against ignition and flame failure and, perhaps the most important, control failure.

(b) *For semi-automatic and industrial burners.*

Although frequently applied to hand-ignited burners, they are increasingly used in conjunction with auto-ignition on low flame and thereafter operate the burner at either max or min setting as the load dictates. This is a robust system which produces results which give varying degrees of satisfaction.

(c) *Modulating Controls.*

Whereas the high-low or max-min type of control is designed to operate the burner at one of two levels, the modulating control may be designed to operate the burner at any of, say, ten stages. It is so designed that at any stage the air introduced will be in proportion to the fuel burned. Not every burner will work at a constant CO_2 over a turn down range of four to one. With the high, medium, or low pressure air blast burner it is fairly easy, but when using a pressure jet burner, unless the air register is well designed and the available air pressure reasonably high, successful results are not likely to be obtained over a wide range.

Where the load fluctuates over a wide range and changes quickly, it is doubtful whether the modulating burner really operates for long on any of the intermediate stages. The attractive feature of this type of control is the knowledge that whether it is passing from the high to the low position or the reverse, at no time will there be a vast amount of excess air or such a shortage as to cause visible smoke.

The design of a good high-low system is not easy because in going from the high flame setting to the low, if the oil flow decreases too rapidly in relation to the air supply, the flame may cool and be extinguished. If the opposite occurs, the air shut off may precede that of the oil, and smoke will be caused. Usually the change is effected by small electric motors which operate simultaneously oil valves and air dampers. It needs skill to design these components so that when opening and shutting their delivery is matched. In the case of the fully modulating burner, the matching is achieved by a fully-adjustable cam. Examples of such controls are found on the first true "packaged heat" boiler—the Velox, and on many modern boiler units.

One cause of trouble for both high-low and modulating burners is the induced draught fan. The friction through the flame tube and return tubes of a shell type boiler varies approximately as the square of the load. This means that if at full load the friction through the boiler is $1\frac{1}{2}$ inch W.G. and the operation of the burner demands a depression in the combustion chamber of 1 inch W.G., the I.D. fan must be designed to pass the products of combustion at full load with a pull of $2\frac{1}{2}$ inches W.G. If the load goes to a third of full load, then the volume of gas to be handled is rather less than a third and the friction through the boiler will be reduced to about 0·166 inch W.G. The characteristics of the fan may be such that when the air inlets of the register close to the low flame position, the suction at fan inlet will remain constant or even increase slightly. Since the friction in the boiler is now negligible, the depression in the combustion chamber becomes very big and one may induce the smaller quantity of air through the partially closed air register at very high speed, to the detriment of flame stability and combustion efficiency. To avoid this, in some installations arrangements are made for the speed of the fan to be controlled so that it goes to slow speed when the burner goes to low flame.

With the exception of the very smallest burners, which are fed by constant level devices, and industrial furnaces under constant supervision, all oil-burning installations should be equipped with a flame failure device and, when ignition is automatic, an ignition failure safety device. These either embody a bi-metallic element or a radiation-electric cell. Some of these are photoelectric cells which pass current when the radiation from the flame falls upon them. In others, use is made of the change in rectification properties of the cell when exposed to the flame. In all the systems, two safeguards are essential:—

(*a*) When the burner is lit by hand, the safety device must be put out of action during this operation, which may last one or two minutes. The safety device must be such that when ignition has been obtained, it is not possible for the operator to walk away and leave the control in the "off" position. There are valves with special circuits which make this impossible and an ordinary clockwork time-delay switch will give the same result;

(*b*) All electric circuits, especially those embodying thermionic valves, must be designed so that, in the event of failure of a component, the fault is brought to the notice of the operator and preferably the circuit will not operate. To devise such safeguards is not easy, especially as during the warming up period a thermionic valve is not in an operative state and it is therefore difficult to tell whether such controls are in order during the first few minutes after switching on the electricity supply.

The advent of automatic fuel and air control together with automatic feed regulation has made the stokerless boiler room a reality. In the place of the stoker there will be the skilled instrument mechanic, because this multiplication of instruments calls for careful adjustment and maintenance.

The remainder of this article describes some uses of oil burning equipment.

The Power Station

Up to the present time in the United Kingdom very little liquid fuel has been burned in power stations, but the official programme envisages the use of 6 million tons per year for this purpose. Fig 14 shows an overseas station containing two 100-mW boilers. In each will be burned some 60,000 lb/hr of fuel to generate some 900,000 lb of steam. The station will consume about 1200 tons per day. The fuel may be brought by tanker from the refinery to a wharf near the power station and can be pumped by the ship's pumps into the station's storage tanks, which must be of sufficient capacity to ensure the continuous operation of the station in spite of any natural causes which might temporarily delay deliveries.

These tanks hold 48,000 tons, enough to run the station for 40 days. To transfer the fuel with reasonable expenditure

of power, the tanks will each have a ground coil capable of maintaining the contents at about 120° F. From the main tanks the fuel will be pumped by transfer pumps to the boiler house or, if there is any chance of sea water contamination, it may be felt desirable to interpose two daily tanks, one in use and the other permitting the oil to be kept hot in readiness for the next day. The use of such tanks is growing more rare.

As this station uses pressure jet burners, the fuel is then taken over by the pumping and heating units, where it is raised to burning temperature which will be sufficient to reduce the viscosity to about 120 sec Redwood I. In this case the 25-h.p. transfer pumps handle the oil at 120° F and 100 psi, and then the 125-h.p. pumping and heating units raise the temperature to 215° F and 1070 psi. From these units the fuel passes around the ring main, which is thermally insulated and which carries about 50 per cent more fuel than the capacity of the burners, returning the surplus to tank suction. This minimizes the temperature drop between pumping and heating set and the burners. The burners are

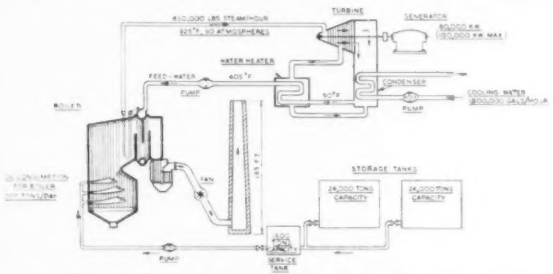


Fig 14. *Schematic arrangement of* 1000 *mW oil-fired power station.*

set in three rows and are inserted through the wind box in which the air for combustion is delivered from the air heaters at 690° F and 8 inches W.G. The burners each handle about 5000 lb/hr. Nevertheless, the high atomizing pressure and the high velocity of the air through the registers produce a very high quality of combustion, which ensures that the flames will end before travelling the 30 feet to the back wall.

The main burners are used unless the load falls below 30 per cent of full load, when blast burners using steam for atomization are substituted, the change-over only taking a few seconds. Air and steam lines are brought adjacent to each register so that, when starting from cold, the steam jet atomizers can be operated on compressed air.

Automatic control regulates the fuel–air ratio to maintain a high efficiency and the fuel used per unit is expected to be 0·59 lb showing an efficiency of 31 per cent.

In contrast to the conventional station just described is a Swedish boiler of 60 mW designed to take the load when the conditions in the hydro stations many hundreds of miles away require. The boiler shown in Fig 15 is designed to take up full load in some 30 minutes. It will be seen that the gases make no turns when passing up this specially designed "tower" boiler. The boiler can be fired by either pulverized fuel or by liquid fuel but the management prefer to run on both simultaneously. The pressure jet oil burners are inserted through the centre of the P.F. burners and both use the same air registers. The combustion chamber is octagonal and the burners, in three tiers of eight, each fire tangentially into the chamber, creating a ring of flame. The products of combustion rise and pass through superheaters, rotary air heaters, and cyclone grit arresters to the short stacks. The efficiency is high and as the boilers are only operating intermittently for comparatively short periods, special precautions are taken to combat low-temperature corrosion.

The modern power station generates steam superheated to 1000°–1050° F. The outer surface of the preheater tube may be 50° F hotter. To transfer the necessary heat to the superheater it must be placed in a gas stream, where the products of combustion at entry are probably 800° F hotter than the metal. If the hangers of the superheater or the metal parts acting as spacers between the tubes should reach gas temperature, their life would be limited due to exposure to products of combustion containing appreciable quantities of free oxygen and water vapour. The deterioration of the metal will certainly be accelerated if there is deposition of ash, the constituents of which combined with sulphur are known to intensify scaling in certain temperature bands. To minimize this effect, great care must be taken in the selection of the metal for the superheater supports and to ensure that as far as possible these supports will be adequately cooled, preferably by the internal passage of steam. This may not be possible in the case of the tube spacers. For these, a careful analysis should be made in an endeavour to estimate the likely true temperature conditions during operation, bearing in mind the limitations of heat transfer by conduction along lengthy metal strips somewhat loosely attached at the ends to steam tubes, and the enhanced convection heat transfer factors associated with edges facing upstream in the gas passage.

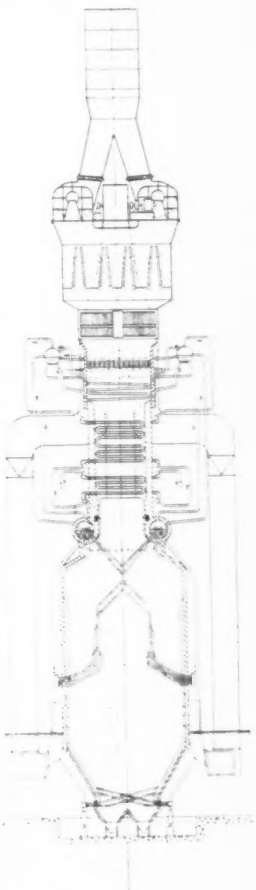


Fig 15. *Västeras power station boiler.*

Shell Type Boilers

In contrast to these giant boilers, there is the shell type boiler generating perhaps 5000 to 15,000 lb of steam per hour. Fig 16 shows one fired by two low-pressure air spinning cup burners. The burners are self-igniting at low flame with gas-electric ignition, and thereafter operate with a range of about 3 to 1. The CO_2 can be maintained at 11 to 13 per cent throughout the range and the quality of combustion is very high, as indicated by the very small weight of soot swept each week from the convection tube surfaces.

Fig 17 shows a packaged heat boiler, which type of plant was the subject of such favourable comment by the Boon Committee when they returned from their fuel and productivity fact-finding tour of the U.S.A. All accessories

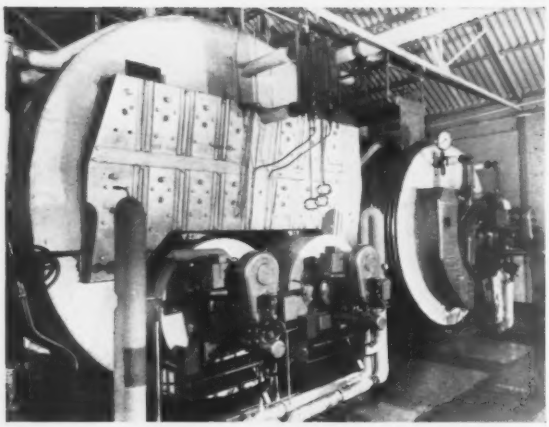


Fig 16. *Rotary burners on shell type boilers of* 7500 *and* 5000 *lb/hour.*

needed to serve the boiler are mounted with it on a bedplate. Such boilers are usually given a lengthy steaming test and all controls put through their paces before the assembly leaves the factory. On arrival at its destination, it is merely placed on the boiler room floor, connected to water, oil, electricity, and the steam mains, and it is ready for use.

These packaged heat boilers are independent of chimney draught, since they are always equipped with either I.D. or F.D. fans or both. The chimney is therefore merely an instrument for carrying the gases to an adequate height so as to ensure a reasonable dispersal of the waste gases. There is, however, one aspect of chimney construction which tends to be overlooked. These boilers are very efficient, the exit flue gas temperature being in certain cases guaranteed to be not greater than 150° F more than the steam temperature, so that in a boiler generating steam at 100 psi the exit gas temperature may be about 480° F, and in certain cases may get as low as 400° F. Gases at this low temperature, if taken up a bare steel chimney, will cool rapidly even in good climatic conditions. When, however, it is raining or there is a strong cross wind, the temperature drop of the gases in passing to the top of the chimney will be increased, with the result that in the upper part of the chimney the metal plates forming the chimney will certainly be below the acid dewpoint, say, 300° F, and in many investigated cases will actually be below the water dewpoint, say, 120° F. The trouble is accentuated at low loads. The result is that at certain times the inside of the chimney will be moist with dilute acid and water. This may act as a fly paper, retaining on the surface a vast number of minute particles which, if emitted as individuals from the chimney themselves, would be invisible and inoffensive. However, when the quantity of such particles forms a paste or growth on the inside of the upper part of the chimney, and the weather improves or the load increases, the tidemark in the chimney will tend to rise, permitting the zone between high and low tide to dry out, flake off, and pass out of the chimney in the form of large soot particles which can be a source of great annoyance to neighbours. It is advisable, therefore, when burning liquid fuels to see that the chimney is adequately insulated so as to keep the metal above the water dewpoint, and preferably above the acid dewpoint. Insulation on the inside will protect the metal of the chimney from corrosion.

Open Hearth Steel Furnaces

In most industrial furnaces the process only involves transferring heat from products of combustion to the material to be warmed or melted. In contrast, the open hearth steel furnace combines the function of a heating furnace with that of a chemical retort in which certain chemical changes are effected by the interaction of charge and slag. The process is of the batch type and embodies several distinct phases. To suit these phases, the oil-burning system has got to be flexible.

The designs of open hearth furnaces show that they were originally developed for gaseous fuels. The fuel and air ports were so arranged as to give rapid and correct mixing of relatively slow moving masses of air and gas. The introduction of a narrow-angled fast-moving jet of steam and oil was an innovation. Research over recent years by the steel industry and by the International Flame Radiation Committee have indicated some of the factors to be considered when designing these furnaces for liquid fuels. To-day, about half the steel made in the United Kingdom is made in furnaces fired with liquid fuel.

The burners used are of the high-velocity injector type employing one-third or one-half a pound of steam or air to introduce each pound of oil into the furnace in a narrow-angled spray directed towards the surface of the slag. The fuel output per burner is large, *e.g.* on the 200-ton basic fixed O.H. furnace, 500 gal/hr, *i.e.* over two tons per hour, is burned during the melting down period. For atomization, steam is more usually employed than air mainly because it is easier to provide a source of one or two tons of steam per hour than compressed air at 80 or 100 psi. The burner is water-cooled either for one or two feet at the jet end or throughout its length. Two kinds of burners are commonly used, external mixers where the injecting medium meets the fuel at the mouth of the burner and internal back end mixers. In this latter type, the steam or air expands in two stages. The first occurs at the inlet end of the burner where the steam develops some velocity and meets the fuel. The froth then travels at speed down the body of the burner and the main pressure drop and velocity gain occurs at the nose. This latter type would seem to have a higher frictional loss, but it has only one orifice, and that of a size less likely to foul when exposed to the radiant heat of the furnace.

Fig 18 shows a 200-ton capacity basic fixed open hearth furnace. The fuel consumption varies from 230 to 500

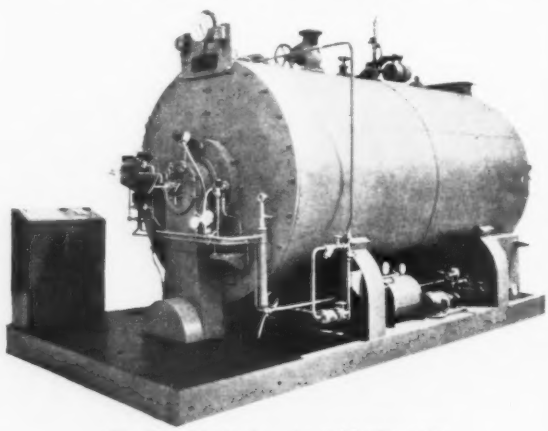


Fig 17. *Typical packaged boiler unit.*

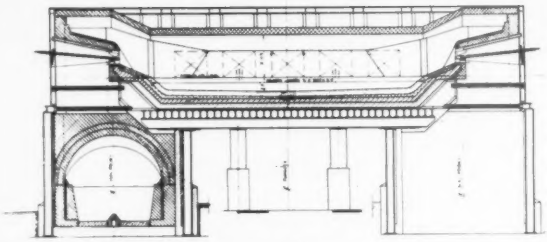


Fig 18. *Arrangement of* 200*-ton open-hearth furnace. Longitudinal section on centre line of furnace.*

gallons per hour. During the melt down the rate of fuel consumption is controlled to a limit dictated by the maximum feasible temperature of the furnace roof. When this furnace is fed with 50 per cent hot metal, the specific fuel consumption is about 18 gal/ton of steel.

In some respects the open hearth furnace resembles the glass melting tank in so far as in both a process of refining is carried out. Further, in both, a very large proportion of the heat put into the furnace goes to maintain the furnace at high temperature and not into the material heated. The overheads, both financial and thermal, being so high, any factor which can help to increase production from a furnace of a given size results in considerable economy. In the case of liquid fuel the factors are the high calorific value and high theoretical flame temperature, together with a radiation emissivity factor which, in the first few feet of the flame, has been proved to be little less than that of a black body. It is these properties which enable an oil flame to transmit heat at an intense rate to materials only a few hundred degrees cooler than the flame. For such applications, liquid fuel is successfully and rightly chosen to play an important part in the fuel economy of any highly industrialized country.

New Developments

The oil-fired boiler and open hearth furnace represent industrial applications of oil firing which have been established for many years. There are, however, more recent developments in the technique of oil firing.

Brick Kilns

The continuous brick kiln consists of a chain of chambers arranged in circular or oval form. The process of loading, firing, and emptying the kiln goes on continuously. Into two or three of the chambers fuel is introduced and this firing zone travels slowly round the circle, taking two or three weeks to complete a circuit. The rest of the kiln is divided into two zones. In one, the bricks which have been cooked

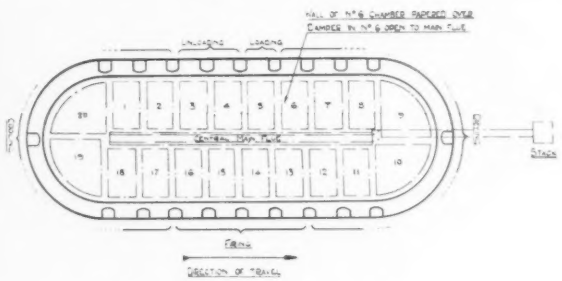


Fig 19. *Plan of continuous brick kiln.*

are giving up their heat to the incoming air for combustion and in the other the outgoing products of combustion are drying and preheating the bricks newly-loaded into the kiln. In theory the process should be highly efficient, the fuel requirement being only that needed to make good external losses, to remove the moisture in the brick, and for a small steam and sensible heat loss in the outgoing products of combustion. When fired with solid fuel, it is either burned on grates along the side of the kiln or dropped as slack through holes in the kiln top.

When oil-fired, blast burners can be used for narrow kilns so that the flames are launched from the existing firing holes across the kiln through lanes left in the stacked bricks. Where top firing has been employed, oil can be dripped from

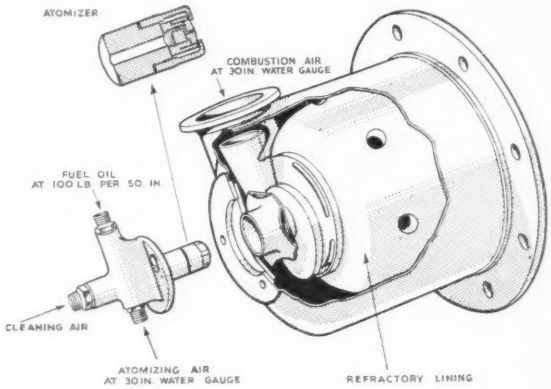

ATOMIZER
COMBUSTION AIR AT 30 IN. WATER GAUGE
FUEL OIL AT 100 LB. PER SQ. IN.
CLEANING AIR
ATOMIZING AIR AT 30 IN. WATER GAUGE
REFRACTORY LINING

Fig 20.

a number of points into funnels left in the stacking of the kiln, as in Fig 19. Each drip passes about 0·4 gal/hr and difficulties sometimes arise in maintaining a constant rate of drip.

In two new systems used on the Continent, the problem has been solved by the use of injectors which squirt the fuel intermittently into the kiln. In one system, a measured quantity is directed into the kiln from all injectors simultaneously by collapsing momentarily the pressure in the oil main connecting the injectors with the pump.

In the other and newer system, all the injectors (Fig 20) are connected with a ring main through which hot oil circulates and receive oil intermittently through electric solenoid valves which are operated three or four times per minute by a central controlling timing switch. In both systems the number of injections per minute and the amount of oil per injection can be controlled and adjusted while the plant is running.

High Intensity Combustion

There are applications where for one reason or another it is desirable to burn the fuel in as small a space as possible. Such applications include:—

(*a*) *The aero or marine gas turbine.*
Here there are obvious reasons for wishing to economize in space and weight.

(*b*) *Air heaters and stills.*
One of the outstanding advantages of liquid fuel is the high emissivity of its flame, which gives it a radiating power even greater than that of pulverized coal. There are, however, cases where this strong radiation can prove embarrassing. These generally concern the heating of fluids or gases in metal tubes, where the heat transfer

from metal to gas or fluid is low and hence, if the tube is exposed to the full glare of an oil flame, the metal may become overheated and consequently damaged. In such cases, it is an advantage to burn the fuel in a pre-combustion chamber, usually at a high rate in lb/cu. ft/hr, and then to liberate the gases after burning is complete, so that the receiving surface is only subjected to gaseous radiation from H_2O and CO_2, which is far less severe than that from the living flame.

(*c*) For firing into confined spaces, for example, the small diameter furnaces of some shell type boilers.

(*d*) For certain furnaces where the success of the design depends on the products of combustion being circulated very rapidly round the setting.

(*e*) In those industrial applications where it is desired to pass the products of combustion through a liquid, and hence the combustion chamber pressure must be greater than the static head of liquid.

Fig 21 shows an industrial high-intensity burner and pre-combustion chamber which owes much to aero-gas turbine developments during and since the war. All the air is supplied at 30 inches W.G. and it is possible to burn 25 gal/hr in a length of 2 feet.

Fig 22 shows another high-intensity system, a pre-combustion chamber shaped like two cones joined base to base. The burner is applied at one end with about 5 per cent of the combustion air, the rest being introduced through a large number of ceramic tubes at 30 inches W.G., the combustion rate being 50 lb/cu. ft/hr.

Gasification

Fig 23 shows an apparatus of French design into which it is possible to pour the heaviest fuel oil and from which issues a hot dirty gas. This gas has an intrinsic calorific value of 135 B.t.u/cu. ft. and carries with it perhaps 25 to 40 per cent of the carbon in the fuel in the form of very finely divided soot. This carbon, together with the sensible heat in the gas, gives it a true calorific value of approximately 230 B.t.u/cu. ft. The gasifier can be regarded as a means of two-stage combustion. It is made in sizes from 10 gal to over 1 ton per hour.

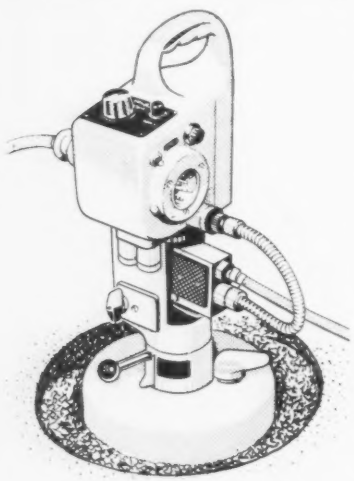


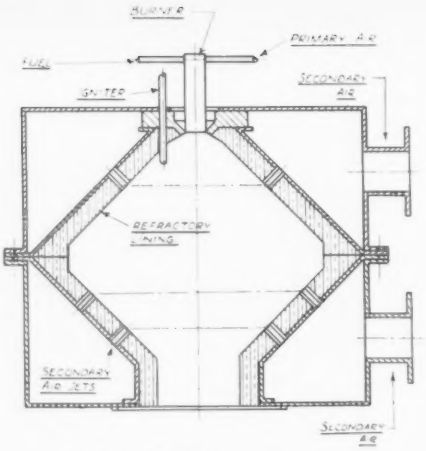
Fig 21.

Evidence is accumulating that the burning of liquid fuel by this gasifier or two-stage combustion process may have very real metallurgical and chemical advantages in those cases where the metals or glass being heated may be sensitive to the effect of the products of combustion of liquid fuel when burned in orthodox burners.

Conclusion

In describing the range of classical burners, pressure jet, blast, and hybrid, an endeavour has been made to show that the development of so many types of oil burners, far from being an indication of commercial competition, is a logical effort to meet the requirements of many differing industrial applications.

Although it has been difficult to compress the information within the compass of a comparatively short article, nevertheless if the principles involved have been made clear, it should help those who already own oil burners to view them with more sympathy and understanding. For those about to instal oil-burning equipment, perhaps they will be helped to understand the burner manufacturer's proposals and to select the right burner for the application concerned.



SECTION THRO' HIGH INTENSITY COMBUSTION CHAMBER

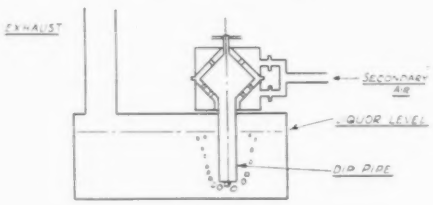


DIAGRAM OF COMBUSTION CHAMBER WITH SUBMERGED OUTLET

Fig 22.

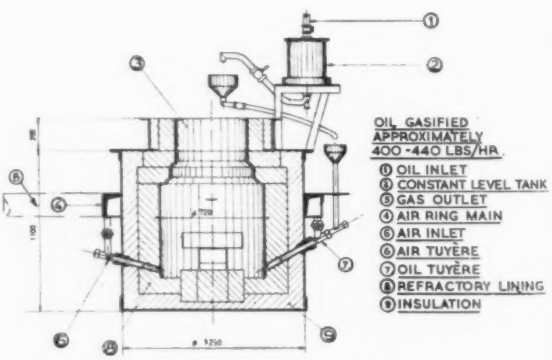


Fig 23. *Arrangement of oil gasifier.*

Around the Branches

BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Bahrain Branch

On 5 August in the P.C.L. Guest House, Manama, a large gathering of members and guests of the IP Bahrain Branch listened to a talk given by Dr G. F. N. Anderson, chief medical officer of the Qatar Petroleum Company.

Dr Anderson's talk concerned the special techniques and equipment which have been devised to cope with all phases of medical work in his "parish", which embraces all the scattered locations of Q.P.C's activities.

In such an undeveloped area of rugged country, where it is impossible to maintain a full medical staff in attendance for every small community of drillers or geologists, it was stressed that to deal most effectively with emergency situations, the requirements are, in order of priority, efficient radio contact with the base hospital, aircraft, and doctors.

However, to deal with day-by-day ailments of a minor nature, a miniature hospital, complete with a 3-bed ward, dispensary, and portable X-ray apparatus, is supplied to most wildcat locations. In addition, regular dental service is given at the work sites by a flying dentist, equipped with completely portable dentist's chair and drill.

Specially fitted Land Rovers have been found to be most suitable vehicles for the mobile surgeries which are required to cross the rough and usually roadless country to give medical assistance wherever it is needed.

Dr Anderson concluded his talk, which was illustrated throughout by photographs, by praising his Company for the liberal financial support it gave to ensure adequate medical facilities not only for employees but for the local inhabitants as well.

Dr K. B. LeGalley then proposed a vote of thanks to the speaker and the chairman, W. H. Cotter, declared the meeting closed.

Trinidad Branch Dinner

The Trinidad Branch of the Institute held their 19th Annual Dinner on 18 May at the Queen's Park Hotel, Port-of-Spain, under the patronage of His Excellency the Governor. The guests of the Institute included Mr Macaulay, President of the Institute of Mechanical Engineers, Prof Webster of the Imperial College of Tropical Agriculture, and Dr Forsythe, Director of the Colonial Microbiological Institute. Unfortunately owing to pressing matters connected with West Indian Federation meetings, Dr Eric Williams, the Chief Minister, was unable to attend.

The dinner followed the customary pattern, and after justice had been done to the menu the chairman, Mr Costelloe, proposed the toast of "The Queen". Then followed the toast of "the Institute" ably and amusingly proposed by Dr Forsythe. In replying, Mr Costelloe, after welcoming the Governor and the distinguished guests, drew attention to certain changes

His Excellency the Governor, Sir Edward Betham Beetham, K.C.M.G., C.V.O., O.B.E., arriving at the 19th Annual Dinner of the IP Trinidad Branch. He is accompanied by H. C. Costelloe, chairman of the Branch, Lieut R. B. Jamieson, R.N., his A.D.C., and G. R. V. Hillier, Branch hon. secretary.

which had taken place during the year, as a result of which he felt it would be of some interest to trace the history of the Institute and particularly of the Trinidad Branch, which was founded in 1928. It was noted with pleasure that two of the founder members, namely W. J. C. Cooke and P. E. T. O'Connor, were present, and were both actively associated with the oil industry of Trinidad. The President then mentioned the introduction of the new local, non-corporate membership which was designed to enable those associated with the industry, but who lacked either the technical or service qualifications for full membership, to take part in the technical and social meetings of the Branch. This innovation was introduced at the beginning of 1957 and was proving attractive to oil industry personnel, and had so far resulted in a 25 per cent increase in membership. It was a pleasure to welcome a number of these new members to the annual dinner.

In concluding, Mr Costelloe emphasized the part that the Institute, as a body of technical and professional men, has played and will continue to play in the progress of the Trinidad oil industry and the growing prosperity of the island of Trinidad.

Mr O'Connor proposed the toast of "Our Guests" to which Mr Macaulay made fitting reply, bringing to conclusion what was by general consent a very successful evening. A record number of 130 members and their guests attended.

Personal Notes

Dr C. M. Cawley, C.B.E., D.Sc., Ph.D., F.R.I.C., F.Inst.Pet., of the Department of Scientific and Industrial Research, has been appointed chairman of the Admiralty Fuels and Lubricants Advisory Committee. He succeeds **Lord Geddes,** who has resigned the chairmanship after six years of service to that Committee and to the Admiralty Oil Quality Committee that preceded it. Lord Geddes will remain a member of the Committee.

Dr C. M. Cawley has also been promoted to the rank of Chief Scientific Officer on his appointment to a new post in the Headquarters Office of D.S.I.R. as Director of the Stations and Grants Divisions, dealing with the Department's research establishments and the making of grants to research workers and students.

R. B. Rogers, M.Inst.Pet, who has recently retired as manager of the London office of National Supply Company, has been associated with that organization since 1921, having previously been in the oil industry since 1913, when he took up a position with the Anglo-Egyptian Oilfields Ltd and worked in Gemsah and Hurgada. He was appointed manager of National's London office in 1936 and occupied that position until the end of July when he retired. When the Company acquired Oilwell Engineering Co. Ltd at Stockport and extended their manufacturing activities in Britain, R. B. Rogers became a member of the board of the National Supply Co. He was well known as a founder member of the Oil Industries Club and for a period of 7 years acted as its honorary secretary. **Charles T. Reichert** has been appointed manager of the London office in succession to Mr Rogers. Mr Reichert started with National in 1916 and during the last war was with the U.S. Government's Petroleum Administration for War. In 1953 he spent some time in Europe for the Company's export division.

J. W. Atwell, M.Sc., M.I.Mech.E., has been appointed assistant director of the Executive Board at Cathcart of G. & J. Weir Ltd. He joined Weir's as works manager in February 1954 and became works director on formation of the Executive Board in May 1955.

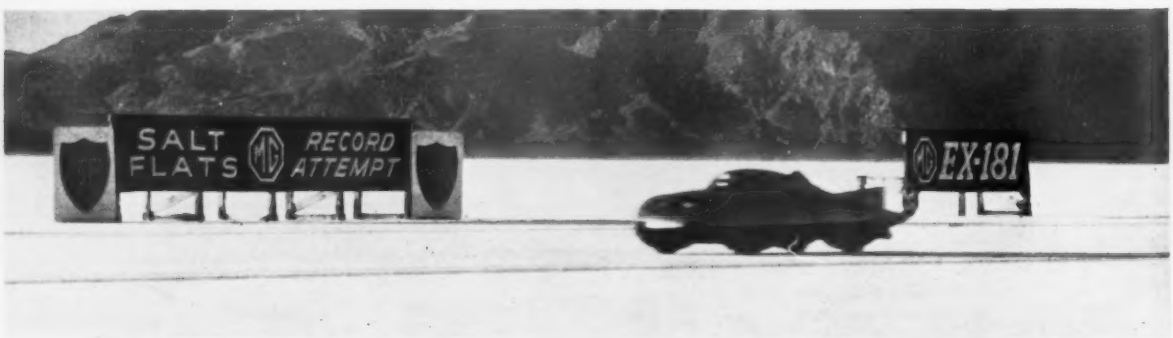
Harold Elliott, who recently retired after thirty-two years as Mobil Oil Company's industrial representative in Northamptonshire, is succeeded by **C. T. Wheatcroft.** The latter joined the Company in 1953, having previously been with A. V. Roe Ltd, the Michelin Tyre Co., and British Insulated Callender's Cables Ltd.

R. Walker, chairman of The Cape Asbestos Co. Ltd since 1934, has retired from the Board of Directors. **G. Newton,** deputy-chairman and managing director, has been elected chairman and **R. H. Dent** and **T. C. Hale** have been appointed joint managing directors. **R. Riley** is to concentrate upon the control and co-ordination of sales throughout the Group and **T. Muir Warden,** who has been Mr Walker's alternate since 1954, has been appointed a member of the Board.

David Andrew, secretary of the Burmah Oil Company, Glasgow, gained first place, and thereby the S. Laurence Gill Prize, in the June examinations of The Institute of Cost & Works Accountants.

T. Tait, D.Sc., Ph.D., F.Inst.Pet., who was appointed assistant general manager at BP Refinery (Kent) in June, first joined BP in 1933. In 1938 he was made chief chemist (research) at Sunbury Research Station, in 1953 assistant manager (development) in Research and Development Division, and in 1956 he became manager, U.K. Division, Refineries Department.

RECORDS ON BP FUEL



A BP photograph

Driven by Stirling Moss, the M.G. EX-181, using BP fuel, is seen here racing across the Bonneville Salt Flats, Utah, on 22 August, when Moss established the following five new Class F records: one kilometre, 245·64 m.p.h.; one mile, 245·11 m.p.h.; 5 kilometres, 243·08 m.p.h.; 5 miles, 235·69 m.p.h.; and 10 kilometres, 224·7 m.p.h. This experimental car was developed by the British Motor Corporation.

Notes of the Month

Jet Fuel Data

It was announced by ASTM Committee D-2 recently that it will recommend for publication this year for information the proposed methods of test for Thermostability Techniques for Jet Fuels. It is expected that these methods, which are based on work done by the CRC, will be included in the 1957 edition of *ASTM Standards on Petroleum Products and Lubricants*.

Study Group on Nuclear Problems

ASTM Committee D-2 has set up a new Group to give consideration to the effects of nuclear and high energy radiation on petroleum products and lubricants.

Oil-Mapping Symbols

API Recommended Practice 35, the first edition of which has recently been published, covers oil-mapping symbols in regard to the status of wells. The symbols follow a logical sequence of operations, from first location to final abandonment, covering the intermediate stages such as oil well, gas well, distillate well, and so on. Only one erasure is necessary, in the case of an abandoned location.

WPC Canadian Meeting

The preliminary time-table for the Canadian Sectional Meeting of the World Power Conference, to be held in Montreal, 7–11 September 1958, gives some information regarding post-conference tours. The latter include a visit by special plane to the Alberta oilfields, provided that a sufficient number of delegates are interested. Full details of the meeting and of the tours are expected by the end of 1957.

Special Trucks to Fuel Viscounts

Nine fuelling trucks, designed to allow speedy fuelling of the new Vickers Viscount 800 airliners, are now in service at Schiphol Airport, Amsterdam. Two of these vehicles are able to pump approximately 400 gallons of kerosine per minute into the Viscounts, and the other seven, which are smaller in size, have a pumping capacity of approximately 230 gallons per minute.

The trucks are being operated by Shell Nederland N.V., who ordered them specially for fuelling the Viscounts.

Pakistan Refinery

The Government of Pakistan announced on 15 July that it has under consideration the setting up of petroleum refining facilities in Pakistan based on imported crude petroleum. The Ministry of Industries said that the Burmah Oil Company Ltd, Shell Petroleum Co, Caltex and Standard-Vacuum Oil Company, the companies distributing oil in Pakistan, had been asked to submit joint proposals for the setting up of a refinery. It has been intimated to the companies that the venture should be handled by a company registered in Pakistan with adequate representation of Pakistan capital.

Airborne Geophysics' Aircraft to Survey Rhodesia

Hunting Geophysics Ltd announces that the United Kingdom Atomic Energy Authority has begun an aerial survey for radioactive minerals over 6000 sq. miles of Southern Rhodesia. A thorough investigation of the chosen area is being made by a Hunting Geophysics' aircraft carrying sensitive recording scintillation ratemeters.

By flying this equipment at a height of 450 feet the changes in the radioactivity from the ground below will be recorded. The aeroplane flies up and down on lines spaced at intervals of a quarter of a mile. When strong radioactivity is detected the position will be recorded by aerial photographs and later marked on a map. These maps will be published at intervals throughout the survey and will be displayed simultaneously in several public places.

Butyl Rubber Tyres

It has been announced from Washington by the Department of the U.S. Army that an all-synthetic, heavy-duty truck tyre has been developed which "represents the closest approach yet to making the U.S.A. entirely free of dependence on natural rubber for defence".

The tyres are made of butyl rubber, which was invented in 1937 by Dr William J. Sparks and Robert M. Thomas, of Esso Research and Engineering Company. The new tyres are the result of three years of research by Esso and the Pennsylvania Tyre Company. The butyl is compounded with improved modifying agents which increase resiliency, resulting in lower heat generation. Cross-country and road tests have shown the butyl tyres to be at least equal or superior to military tyres now being manufactured.

Pakistan Gas Developments

Pakistan Petroleum Ltd brought in its first gas well at Sylhet, East Pakistan, on 20 July. Flow through 2-inch tubing was nearly 15 million cu. ft. per day and the flow potential is calculated at over 100 million cu. ft. per day. The well is therefore comparable with the Sui wells. Drilling commenced on 6 May and within 30 days the drill had reached the gas horizon at 4000 ft. The well is now ready for production.

Two previous wells were drilled in the area. The first, the discovery well, blew out through a crater about 200 yards from the well in May 1955 and caught fire. Sylhet No. 2 had reached a depth of 9245 ft in September 1956 when high pressures made further drilling dangerous. It was then abandoned.

The Sylhet gas field is the first source of indigenous fuel in East Pakistan and the latest indications are that there is a proved reserve of 150 thousand million cubic feet, with possible reserves of 210 thousand million cubic feet.

The gas has a calorific value of 1000 B.t.u. per cubic foot and is said to be "purer" than the Sui gas.

A preliminary survey has been made for an 8-inch high-pressure pipeline to carry the gas to Dacca and industrial centres *en route*. The possibility of smaller lines to other areas is also under consideration.

Nigeria Oil Prospects

Future oil prospects are "very hopeful" and commercial production is considerably nearer than seemed possible before the first discovery at Oloibiri in February 1956. This was stated in Lagos by H. Bridges, recently general manager of Shell-BP Petroleum Development Co. of Nigeria Ltd.

He emphasized that the most urgent problem awaiting solution was to find a practical and economic means of

exporting oil from Nigeria in fully-loaded 18,000-ton tankers. No port in Nigeria had a depth of water sufficient to allow modern tankers to be loaded to more than half-capacity. The first shipment of about 9000 tons of oil would be from Port Harcourt early in January 1958.

In 1956 expenditure on oil search in Nigeria was £3¼ million, this year it would exceed £10 million, and in 1958 would be still higher. Ten drilling rigs would be in operation in 1958, he said.

BP Petroleum Chemical Department

The British Petroleum Company announces the formation of a Petroleum Chemicals Department with responsibility for the Company's activities in this field. General manager is D. G. Smith, B.Sc., M.Inst.Pet., and the assistant general manager is D. A. Howes, D.Sc., Ph.D., F.Inst.Pet.

Formation of the new department is accompanied by changes in the Refining and Technical Department, including the following: M. A. L. Banks, B.Sc., F.Inst.Pet., is appointed general manager following the appointment of C. E. Spearing, M.A., F.Inst.Pet., as a director of BP Trading Ltd; S. W. Adey, B.Sc., A.M.Inst.Pet., is deputy general manager; J. Moffat and D. W. K. Barker are appointed assistant general managers responsible respectively for U.K. and Continental refineries and for Eastern and Commonwealth refineries; P. Docksey, A.M.Inst.Pet., is to be co-ordinator, Research and Development.

Nuclear Marine Propulsion

The Joint Nuclear Marine Propulsion Panel has been formed by the Institute of Marine Engineers, the Institution of Naval Architects, the North East Coast Institution of Engineers and Shipbuilders, and the Institution of Engineers and Shipbuilders in Scotland, for the purpose of stimulating and facilitating the presentation and discussion of information regarding the application of nuclear power to marine propulsion.

The first number of the Panel's *Journal*, which is being published by the Institute of Marine Engineers, has just been issued. It is devoted to two articles—"Different Types of Nuclear Reactors", and "Some Safety Considerations of Nuclear Power Reactors" (with discussion)—and a useful "Glossary of Terms Used in Nuclear Physics". For the present the *Journal* will be published at 6-monthly intervals.

NEW OIL PIER FOR KUWAIT

Present oil-loading facilities at Mina-al-Ahmadi consist of the South Pier, equipped with eight loading berths and five sea berths. As announced in our August issue, additional submarine lines were being launched to form two new sea lines, and a ninth gravity line, 32 inches in diameter, was being laid to connect the main tank farm at Ahmadi to the loading terminal.

Kuwait Oil Company now announce that a new pier is to be built in deeper water than the present pier to handle the larger tankers now under construction. Named the North Pier, it will be located about four miles north of the South Pier.

The new pier will be of steel pile construction, providing in the first instance tanker berths to handle three tankers simultaneously of the largest size now contemplated. Pipelines and connexions to tankers will allow average loading rates of 5000 tons an hour, with a maximum rate of 6750 tons an hour. Bunkering, ballast discharge, fire-fighting, tanker crew recreation facilities, and offices will be provided.

The pier head, which will be in 55 to 60 feet of water depending on the state of the tide, will be connected to the shore by an approach trestle, 5700 ft long, comprising pipe track and simple roadway, with passing places, to take vehicles up to 10-ton weight.

The necessary steelwork for the structure has been ordered and contract details are in hand. Preliminary work on site is under way and actual construction will begin in September.

It is expected that the costs of the scheme, which will take about two years to complete, will approach £8 million.

★ ★ ★

Another Petroleum Chemical Plant at Fawley

Union Carbide Project

Union Carbide Ltd is, subject to approval by local authorities, to erect a plant for the manufacture of ethylene oxide derivatives at Fawley, Hants, on a 52-acre site adjacent to the Esso Refinery. Cost of the plant is estimated at about £3 million and initial facilities will cover 25 acres, leaving room for future expansion.

An arrangement has been made for Esso Petroleum Company to supply ethylene gas from its £9-million chemical plant now under construction for the supply of raw materials to the British chemical industry. This same plant will also supply raw materials for plastics and for synthetic rubber manufacture to Monsanto Chemicals Ltd and to The International Synthetic Rubber Co. Ltd.

The Union Carbide plant is scheduled to be operative in 1959, with production capacity of 45 million pounds annually. Manufacturing facilities will include installations for the production of ethylene oxide, ethylene glycols, polyethylene glycols, ethanolamines, glycol-ethers, and specialized products including polyglycol ethers, polyglycol esters, and other surface-active agents. Provision has been made for the storage of large quantities of finished products, and extensive facilities are planned to speed incoming and outgoing transport.

Some of the principal uses of the chemicals to be manufactured include: anti-freeze for cars; manufacture of synthetic fibres, textiles, printing inks, pharmaceuticals, cosmetics, detergents, agricultural chemicals; as solvent in paints and lacquers; components in brake fluid formulations; rubber mould lubricants; and as absorbents in petroleum refining. The most modern specialized chemicals processing equipment permitting a high degree of automation is a feature of the installation. Engineering studies have been completed and plant design is now in its final stages. When completed, the unit will employ over 150 people.

The Fawley plant is the second major petroleum chemical facility in the United Kingdom under construction by the Union Carbide organization. A 24-million pound per year polyethylene plant at Grangemouth, Scotland, was recently completed.

New Books

ICI Engineering Codes and Regulations (Safety)

The latest edition of this 37-page booklet is the first of a series dealing with safety in relation to electrical engineering. It reviews the legislation and other regulations relative to the use of electricity with safety in a chemical works, so that the engineer may consult the appropriate clauses which refer to any specific safety problem.

Since it is not a reprint of safety regulations *in extenso*, it is stressed that the booklet should be read in conjunction with the regulations.

It is well indexed and includes a pocket folder which contains a BSI Sectional List of Standards applicable to electrical engineering. Copies may be obtained from ROSPA at Terminal House, 52 Grosvenor Gardens, London, S.W.1.

Shell-Mex and BP Activities

A supplement to a recent issue of *Shell-BP News*, the monthly magazine of Shell-Mex and BP Ltd and its associated companies—Scottish Oils and Shell-Mex Ltd, and Irish Shell Ltd—was entitled "1956 in Perspective". It reviewed the activities of the companies and showed in no uncertain manner how diverse these can be during the course of the year. Thus, there is a folded inset which must take pride of place for 1956—the rescue by the *BP Distributor* of six of the crew of the m.v. *Teeswood* off Dungeness. At the other end of the scale and appropriately on the last page is shown a petrol coupon, a reminder that the year ended with petrol on ration. Between these two extremes are many reminders of interesting events and achievements.

PIB Wall Map

A complete picture of world oil operations is provided by the new edition of the PIB wall map, which has just been issued. For each country the magnitude of crude oil production and of petroleum refining capacity is shown by coloured symbols and this information is supplemented by a detailed statistical table of production and refining capacity. In addition, the growth of world oil production is illustrated by means of a graph, and a new feature is a diagram showing the sources of U.K. oil imports. Statistical details on the map are for the year 1956 and a space is available for the 1957 figures to be inserted when these are available in about July 1958.

The map, which measures 30 x 40 inches, should prove of considerable value to anyone wishing to have reliable information regarding the distribution of the petroleum industry throughout the world. It is published by Petroleum Information Bureau, 29 New Bond Street, London, W.1 the price being 2s post free.

British Petroleum Equipment

Details of the equipment of over 370 firms supplying materials and plant to the petroleum industry world-wide, and grouped together in the Council of British Manufacturers of Petroleum Equipment, are contained in the 1957/58 Edition of *British Petroleum Equipment*.

The 787 pages of this publication are a veritable mine of information. The first 26 pages are devoted to data on the activities of the Council and to a list of the members, with brief details of their specialities. Then follows 60 pages of a classified list of equipment, ranging from "A" frames to zinc dust. As an indication of the wide variety of products supplied by the members of the Council, a random selection includes bulldozers, cracking plants, footwear, pre-fab houses, mineral water machines, off-shore drilling platforms, wire lines, and X-ray equipment.

The largest bulk of the book is the catalogue section and here illustrations and technical data appertaining to petroleum industry equipment is set out in an attractive and useful manner.

This book is one which the petroleum engineer, the buyer, and in fact any technical man in the industry cannot afford to be without. Its price is £2 10s and it is obtainable from the CBMPE, 2 Princes Row, Buckingham Palace Road, London, S.W.1.

★ ★ ★

NEW BSI STANDARDS

Viscosity in C.G.S. Units

Revised for the first time since 1937, BS 188:1957, "Determination of the Viscosity of Liquids in C.G.S. Units", now includes suspended-level and reversed-flow types under the category of "capillary viscometers" as well as the simple U-tube type. The Cannon-Fenske instrument is also included.

An important change is that water is now the sole reference liquid, master viscometers being calibrated against water at 20·00° C. Method of calibration is described and appendixes deal with various corrections and ancillary apparatus.

The revision takes account of ASTM and IP methods and for glass capillary viscometers is technically equivalent to IP 71. Price of the Standard is 10s and copies are obtainable from the BSI, 2 Park Street, London, W.1.

TEL and Water and Sediment

Two new standards which give national status to IP test methods are BS 2878:1957, "Determination of Tetraethyl Lead in Gasoline", which is technically equivalent to IP 96, and BS 2882:1957, "Determination of Water and Sediment in Crude and Fuel Oils". The latter is technically equivalent to IP 75.

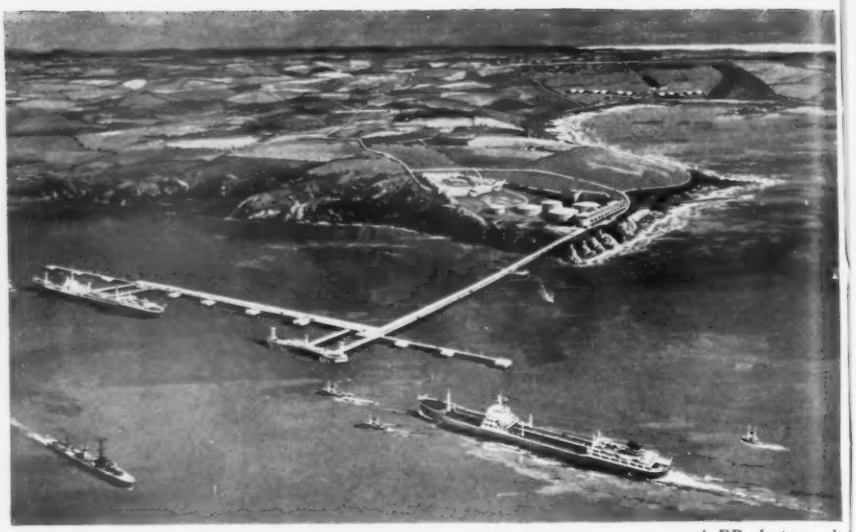
Price of BS 2878 is 3s and of BS 2882 is 4s.

Metric Conversions

The conversion of inch and metric sizes on engineering drawings is important and there has long been a need for a standard practice to ensure the accuracy required for precise interchangeability of dimensions. This need is now met by BS 2856:1957, "Precise Conversion of Inch & Metric Sizes on Engineering Drawings".

Conversion factor used is 1 inch = 25·4 mm (exactly) and the recommended conversion procedure takes the form of simple rules. Examples of application of the rules are given and conversion tables are appended. Price of this Standard is 3s 6d.

Developments in Milford Haven



A BP photograph

An artist's impression of the terminal at Popton Point.

BP Commence Preliminary Work

Preliminary work has begun at BP's new crude oil tanker terminal at Popton Point on the south shore of Milford Haven, Pembrokeshire. This followed the receipt of Royal Assent to the Parliamentary Bill giving the Company permission to proceed with the project, which involves the building of a jetty, the erection of a tank farm, and the laying of a 60-mile pipeline 18 inches in diameter to connect the terminal with the BP refinery at Llandarcy.

A small staff is at present engaged in surveying and fencing the area on which the crude oil storage tanks will be erected. Tenders have been invited for the construction of the jetty.

The facilities in Milford Haven for a crude oil terminal have been under consideration for some time, culminating in the purchase last year of three areas:

(i) Popton Point, which includes Popton Fort, a large Victorian fort in private ownership and which was suitable for the location of the proposed marine terminal;

(ii) A coastal strip of approximately 140 acres extending from Popton Fort along the shore of Angle Bay and terminating at Kilpaison Farm;

(iii) Kilpaison Farm, which comprises approximately 220 acres suited to development as a storage tank farm. It has a frontage of 750 yards on the coast of Angle Bay.

All necessary communicating pipelines between the jetty and the tank farm (a distance of $1\frac{1}{2}$ miles) will be laid below the lands of the coastal strip. A communicating road links the terminal and tank farm.

Great care is being taken in the present planning stage in consultation with the local government and national authorities that all the amenities of the area shall be preserved. Access to the shore of Angle Bay will be open to pedestrians and arrangements are being made to accommodate the Pembroke coastal footpath.

The jetty will be located in the lee of Popton Point to obtain as much shelter as possible from the prevailing westerly winds. The 1350-feet shore arm of the concrete decked jetty will extend from immediately below Popton Fort. The shore arm deck will be supported on piles and a section close in-shore will be available for the passage of small fishing launches beneath the deck. A sea arm at right angles will be 2300 feet long to accommodate two tanker berths. There will be a depth even at low water of nearly 55 feet at the berths, which will be able to receive the largest tankers. A pipe track along the approach arm will support two 26-inch diameter pipelines through which crude oil will be pumped from the tankers to the tank farm. There will also be the necessary service lines for ships' bunkers, fresh water, fire fighting, and other services.

Popton Fort will be preserved and it is proposed to locate tanks for ships' bunker oil and fresh water within its walls. The administrative buildings and control centre will be accommodated in the upper works of the Fort which will be rehabilitated to provide offices for the administration, marine staffs, pilots, H.M. Customs, radio communication, fire station, and other services.

A pumphouse will be built near the tanks erected on Kilpaison Farm and four electrically operated centrifugal pumps, each having a capacity of 2760 gallons a minute, will be used to pump the crude oil to Llandarcy refinery. The pipeline, which will be buried throughout its length, will pass through the counties of Pembrokeshire, Carmarthenshire, and Glamorgan and the borough of Swansea. The route will cross five major rivers as well as roads, railways, and a canal. The pipeline will be capable of carrying 5 million tons of crude oil a year.

Electricity for the Popton Point installation will be drawn from the South Wales Electricity Board's distribution system.

Negotiations are proceeding with Pembroke Rural District Council for a water supply for the terminal and the servicing of ships.

Other Developments

A second Act concerning developments in Milford Haven which has received Royal assent is the Esso Petroleum Company Act 1957. This Act authorizes the Company to build a jetty at Little Wick, Pembrokeshire, extending 3150 feet into Milford Haven, and a jetty head 4730 feet long for berthing vessels.

The preamble to this Act states that the Company has acquired land in the parishes of Herbrandston and Hubberston, Haverfordwest, and propose to establish a refinery there. It is, therefore, expedient that the Company be empowered to construct accommodation for the reception from tankers of crude oil and petroleum products for the refinery and for conveying products from the refinery.

In the Milford Docks Act 1957 which has also received Assent, it is pointed out that it is more economic to transport crude oil by sea in vessels of substantially greater tonnage than heretofore. Milford Haven is almost the only natural harbour in the U.K. where such vessels can be accommodated and no other harbour in the U.K. is so favourably situated. This Act authorizes The Milford Docks Company to extend the existing dry dock by about 2700 square yards, to construct two new dry docks each of about 28,000 square yards, and to build certain quays and jetties.

Petroleum Refining in Ireland

A New Irish Industry Born

"To-day's events can be said to have some significance for Ireland as a whole, as well as for all of us present. Not only has a new Company been formed in the Republic but a new Irish industry has been born". This was said by G. Noble, O.B.E., chairman of the Irish Refining Company Ltd, at a luncheon in Dublin on 22 July following the first Board meeting of the Company.

Commenting on the fact that the Irish Government, by its insistence, must take the major share of the credit for the birth of the new Company, Mr Noble said that "the oil companies were merely the people who had to face up to the problems. Those problems were many and varied and they had necessarily taken a good deal of time and careful study to resolve. They stemmed from the economies of refining on the scale envisaged in Ireland, and the basic problem of making a refinery of its size pay its way.

"The new Company," he continued, "will represent a participation in refining facilities by three large oil groups who already market refined petroleum products in the Republic—Caltex, Esso, and Shell-B.P.". Pointing out that he had deliberately put the list in alphabetical order, he then said that an "association in a joint refinery enterprise of this kind with other companies, each with its own operating practices and philosophies, has required of all the sponsors a close examination of the project from many angles, of which perhaps the least difficult has been the purely technical. The Irish Refining Company will not serve at any stage to secure or protect the business of any of the individual companies. Foremost in the mind of all concerned has been the need to ensure that acceptance of the Irish Government's invitation shall not at any stage impair the freedom of the competition between the marketing companies. It is only through this vigorous competition that you get quality kept up and prices kept down, the proper service given to the customer, and a climate of opinion in which oil companies can progress and fulfil their public responsibilities."

Explaining that the consumption of petroleum products in Ireland had almost trebled since the war, Mr Noble then said: "It is because of this upward trend in the Irish energy curve that the refinery has been designed for an initial yearly production of two million tons of petroleum products. That is perhaps rather a small throughput compared with the more usual scale of our refining operations. This Irish refinery is in some respects rather a special case. None the less, it will have one useful feature in common with all of them—namely, that it will provide regular employment for a number of people both skilled and unskilled."

Mr Noble emphasized that it was the Company's firm intention to use, as far as possible, both Irish labour and Irish materials; also to achieve a predominently Irish staff with mutually satisfactory conditions of employment. Finally, he said: "We aim not to be either a nuisance or an eye-sore! We have proved in many parts of the world that it is quite unnecessary for a refinery to be either of those. We want to be on good terms with our neighbours; we want to cause the minimum inconvenience to those living in the vicinity; we want the refinery to be something of which Ireland can be fond as well as proud."

The Company

Irish Refining Company Ltd has an authorized share capital of £3 million, its directors being G. Noble, O.B.E., F.Inst.Pet., chairman (a director of Esso Petroleum Co. Ltd), S. W. Adey, B.Sc., A.M.Inst.Pet., D. A. C. Dewdney, B.Sc., F.Inst.Pet. (a director of Esso Petroleum Co. Ltd), A. B. Lawrence, Jr. (a joint managing director of Caltex (U.K.) Ltd), and T. W. Mathias, O.B.E., M.A., F.Inst.Pet. General Manager is Dr R. R. Lawton, and refinery manager is I. McCallum, B.Sc., F.Inst.Pet.

The Refinery

To meet the needs of the Irish market, the planned output of the new refinery, which will be located at Whitegate, County Cork, will be two million tons of petroleum products per annum.

The main supplies of crude petroleum will come from the Middle East and the marine terminal will be capable of berthing tankers of up to 47,000 dw tons.

Major units will comprise a crude oil distillation unit, a hydroformer, and a hydrofiner. A unique feature of the refinery will be the extensive use of air cooling in place of the more usual employment of water for this purpose.

Estimated total cost of construction of the refinery is £10 million to £11 million, the main contractor being the Lummus Company Ltd. For the erection of tankage the contractor is Tank Erectors Ltd.

Construction work has begun and it is anticipated that the major units will come on stream in mid-1959.

New Tanker Facilities at Falconara, Italy

By MICHAEL KRAVTCHENKO

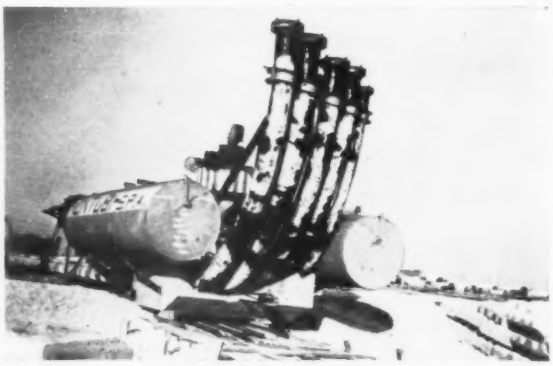
Recently, engineers of Societa' Dalmine S.p.A. completed the difficult task of laying pipelines to link the Falconara, Southern Italy, refinery of Anonima Petroli Italiana with an artificial island already constructed 4175 yards from the shore.

The number of lines laid was six—one 16-inch for crude petroleum, two 14-inch and one 12-inch for refined products, one 8-inch for bunkers, and one 4-inch for water.

The partially-completed lower platform.

Total weight of the six lines was about 2000 tons and, to facilitate operations, the necessary pipe had been laid out on shore in 300-yard bundles. Each bundle consisted of the six pipes, held together by a reinforced-concrete yoke, and weighing about 130 tons. The bundles were pulled out to sea by a powerful winch set up on the island and were carried on large empty tanks acting as floats. In order to avoid undue strain on the structure of the island, the winch was guyed to buoys anchored on the far side. As the end of each bundle reached the shore, a new bundle was welded on. When the whole line was in position it was allowed to sink gently to its permanent location on the sea bed.

The pipe is made to API specification and the submerged portion is not only protected against corrosion by cathodic protection, but also has a 10-layer anti-corrosion sheathing.



The first bundle ready for pulling. The ends are curved ready for vertical connexions to the platform.

The Island

The artificial island which constitutes the pipeline terminus is supported on sixteen 135-foot piles, each consisting of a 20-inch diameter steel pipe driven into the sea bed to a depth of about 50 feet. The two platforms which comprise the island are each about 21 yards in diameter. The lower platform, located about 20 feet above sea level, carries air-conditioned accommodation and service installations for the personnel.

The upper platform, about 33 feet above sea level, is reserved for loading and unloading operations and has two cranes which carry the flexible tubing necessary to connect the shore lines to the tankers.

Tankers will not be moored to the island structure but will

The pipes laid out ready for pulling. In the background is the old 1540-yard line which provided for a draught of only 30 feet.

berth stern on with a clearance of about 16 yards between the island and the ships, the bows being held pointing away from the platform by three anchors.

For unloading purposes tankers will use their own pumps and unloading rates of up to about 3000 tons crude oil per hour are possible. Refined products will be loaded by means of the shore pumps and loading rates of 500 to 800 tons per hour will be achieved according to the specific gravity of the product being handled.

An advantage of the new system is that the supply of water and bunkers to a tanker can proceed at the same time as several products are being loaded.

The depth of water at the platform is about 48 feet and it is therefore possible to berth tankers of up to 60,000 dw tons.

New facilities provided on shore include three new tanks, each of 35,000 cubic metres capacity, and fitted with Horton floating roofs.

The pipes and the rollers on which they were placed for pulling.

Petroleum Research in Alberta

In its report* for the year 1956 the Research Council of Alberta states that work on petroleum during the year led to the realization that petroleum geochemistry was the unifying theme and an effort is being made to co-ordinate the programme with this principle in view. Points mentioned in the report are summarized below.

Petroleum

Oil Sand Studies

The flow of Athabasca oil sand through a hopper was studied with a model hopper based on that successfully used at Bitumount, but the model was unsuitable. For oil sand, the size of opening necessary for flow to take place required hoppers too large to be regarded as models.

Flow factors of a coarse and of a fine clean dry sand through a small hopper were examined, and in both cases flow rate was linearly related to area of the opening. The finer sand flowed slower than the coarse one, and head of sand had no effect on flow rate.

Products from oil-sands oil are being analysed and some fractions from bunker fuel obtained during distillation experiments are to be further studied. Work on sulphur compounds in the oil has continued, but pyrolysis of sulphur compounds over aluminium catalyst was found unreliable from an analytical standpoint. In a study of selective oxidation of thiophenic sulphur by nitric acid satisfactory results were obtained with thiophene. Other sulphur compounds are also oxidized to a minor extent.

Geochemistry

The thermal degradation work has been completed and absolute rates for removal of vanadium and nickel measured and the data extrapolated to geological conditions. The indicated rates are too small to account for the maturation that appears to occur in nature. The rate of porphyrin destruction was also measured and extrapolated. Extrapolated rates for metals and porphyrin indicated that ratio of porphyrin to metals in maturing crude oils should fall off sharply. Examination showed that did not happen with Western Canada crudes and it was concluded that thermal action had had little to do with crude oil maturation in this respect.

A detailed survey of vanadium and nickel in the Pembina oilfield has the object of studying oil migration, and appreciable variations in metal content have been observed. This variation may be a result of adsorption of organic material on the surface of sedimentary rocks with which the oil has come in contact.

Hydrocarbon Research

In attacking the problem of the mechanism of uncatalysed pyrolysis of hydrocarbons, *n*-pentane chains of about 15 units have been produced. The decomposition of halohydrocarbons is to be studied and should yield information on the "molecular" decomposition of the hydrocarbons.

Natural Gas

Pyrolysis of *n*-Butane

The pyrolysis of *n*-butane at about 250° F was investigated, yields of acetylene and ethylene being in the range of commercial interest. The recovery of acetylene and ethylene might be facilitated by the use of diluents other than nitrogen and experiments with natural gas dilution showed some promise.

Separation of Gas Mixtures

Fundamental studies on adsorption are being carried out with the emphasis on compounds in natural gas as well as those in mixtures from pyrolysis reactions.

Geology

In connexion with a groundwater survey in Alberta, a preliminary study has been made on the use of groundwater for water-flooding in the Pembina oilfield.

* Research Council of Alberta. Thirty-seventh Annual Report 1956. Edmonton, Alberta: Research Council of Alberta, 1957. Pp. 48. 5 cents.

Courses and Fellowships

THE SIR JOHN CASS COURSE

The course of lectures on the General Technology of Petroleum, which commenced at the Sir John Cass College on 26 September and which will continue until 3 April 1958, follows the lines of the previous very successful and useful courses arranged by this College in the City of London.

Petroleum technology is completely covered, from exploration and production to research and development. Lecturers are all qualified in their subjects and several visits to refineries and installations are included in the curriculum.

Fee for the Course is 30s, the address of the College being Jewry Street, London, E.C.3.

CONTROL ENGINEERING

The Electrical Engineering Department of the Battersea College of Technology has organized a series of lectures and demonstrations on control engineering. These are designed to introduce engineers, physicists, chemists, and others of similar interests to the possibilities of automatic control.

During the Autumn Term, a series of eleven lectures on Industrial Instrumentation commences on 3 October and will cover measurements in general, dealing with the basic variables—temperature, pressure, level, and flow. The final two lectures will be devoted to the sizing of valves. The fee for this course is £1.

Parallel with the above course is one on Mathematics of Feedback Systems, which commenced on 30 September. This course is intended to bridge the gap between mathematics as taught at B.Sc. level and the Laplace transformation and vector methods now common in servo techniques. Fee for the course is £1.

There is also a series of eleven lectures on the theory and application of Automatic Process Control, commencing on 4 October, the fee for this being £1.

In the Spring Term, the second Industrial Instrumentation Course commences on 6 January 1958. It includes lectures on the measurement and control of conductivity, pH, viscosity, humidity, and radio-chemistry.

Participants should have the equivalent of a B.Sc. degree, or H.N.C., or professional institution status. Full details and application forms are available from The Electrical Engineering Department, Battersea College of Technology, Battersea Park Road, London, S.W.11.

BIM—POLYTECHNIC EXECUTIVE PROGRAMME

A new four-week residential course, jointly sponsored by the British Institute of Management and the Department of Management Studies of the Polytechnic, Regent Street, London, W.1, will be held three times during each academic session. The first course will begin in November 1957.

This is the first senior educational programme of this kind jointly sponsored by the BIM and the Polytechnic.

In its organization and sponsorship as well as in the methods which will be used, this new course is an important departure from current management training. It is the first time that the combined resources of a major professional and academic body will be made available to a senior executive training programme.

The Executive Programme is carefully designed to give managers the opportunity to practise executive skills in a very broad setting. The formal teaching programme will concentrate on discussing some of the new developments in management theory and management practice, recent research findings, and the experience of successful managerial methods in various countries.

The programme will stress the importance of seeing each technical and administrative function as a contribution to the effectiveness of the whole organization.

A major theme will be the need for adaptability to change. The aim is to develop the executive's capacity in dealing with situations of this nature.

Admission

The course is designed for twenty selected executives nominated by their firms.

The fee is 100 guineas, including publications. Hotel accommodation will cost approximately 60 guineas in addition to this fee.

Enquiries should be addressed to:

The Director of the Executive Programme,
Department of Management Studies,
St. Katharine's House,
194 Albany St,
N.W.1.

COMMONWEALTH FUND FELLOWSHIPS

It is announced that Commonwealth Fund Fellowships for study and travel in the United States in 1958 will, in addition to those limited to Civil Servants, include the following:

General—Twenty Fellowships to degree graduates of a U.K. university. Age, 23–32; tenure, 12–21 months; closing date for applications—16 December 1957.

Journalism—Three Fellowships to journalists practising in the U.K. and engaged on opinion-making or broadly editorial side. Age, 23–35; tenure 9–15 months; closing date, 31 December 1957.

American Studies—Four Fellowships to faculty members appointed to or holding posts in American studies in U.K. universities. Tenure, 4–15 months.

Full details are obtainable from The Warden of Harkness House, 35 Portman Square, London, W.1. (after 1 November, 38 Upper Brook Street, London, W.1.).

★ ★ ★

MIDDLE EAST PRODUCTION

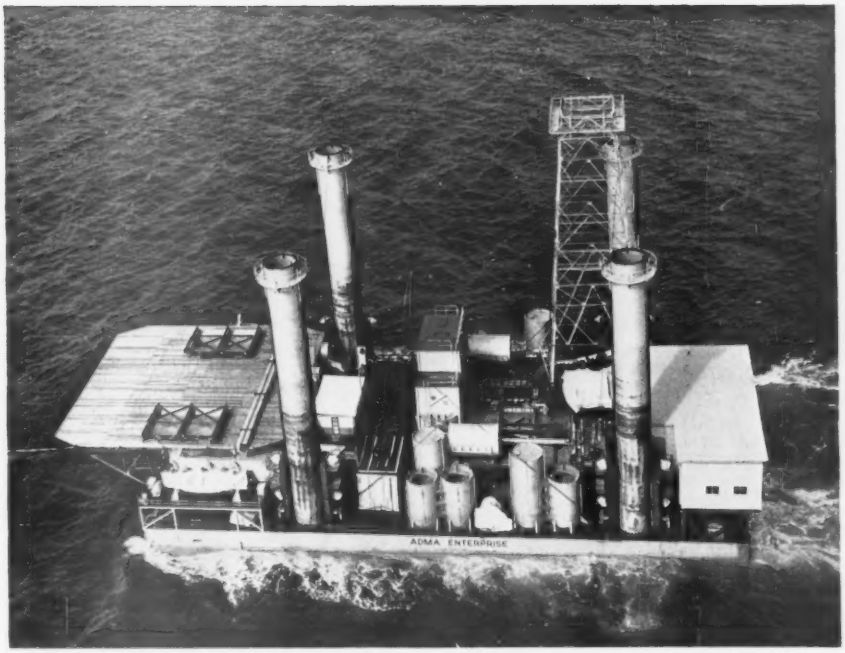
Tons

	July	*Jan.-July*
Iraq Petroleum Co. Ltd ...	1,178,127	4,804,918
Basrah Petroleum Co. Ltd ...	648,427	4,846,576
Mosul Petroleum Co. Ltd ...	51,603	210,683
Qatar Petroleum Co. Ltd ...	630,704	3,544,334
Iraanse Aardolie Exploratie en Productie Mij	3,122,000	19,593,000
Kuwait Oil Co. Ltd	5,420,171	30,656,034

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for July was 1,174,000 tons, the total for 1957 being 9,190,000 tons.

Drilling Barge for Das Island

Details of Adma Enterprise



As Adma Enterprise *travelled through the Straits of Dover* en route *to the Persian Gulf, an excellent view of the arrangement of equipment was obtained.*

Further details are now available of the mobile drilling barge *Adma Enterprise* which, as announced in our June issue, was launched at Adorf on 11 April. The barge is to be towed to Das Island in the Persian Gulf, a distance of 6800 miles, for use by Abu Dhabi Marine Areas Ltd to test the underwater oil possibilities of the 65-year concession which the Company holds over an area of some 12,000 square miles off the Trucial Coast.

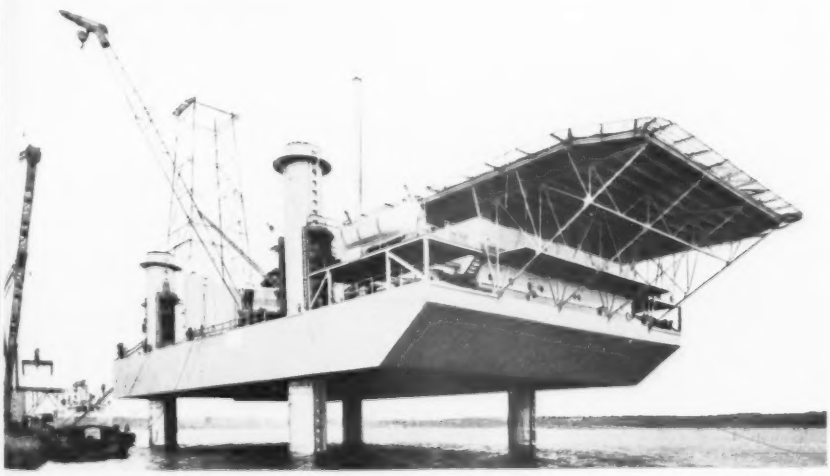
First of its kind to be built in Europe, the barge has been designed by the DeLong Corporation of New York in conjunction with Abu Dhabi Marine Areas Limited for operating in water up to 80 ft deep. It is approximately 200 ft long by 100 ft wide and has a depth of 15 ft. It has four retractable legs each 10 ft in diameter by 165 ft long on which it is elevated or lowered as required by eight DeLong hydraulic jacks. The weight of the barge in the condition in which it is being towed to the Persian Gulf is approximately 4200 tons and its draught approximately 10 ft 6 inches.

A National 130 drilling unit complete with all the necessary drive gear, pipe racks, drill pipe, etc, capable of drilling a hole up to 15,000 ft deep is installed on the barge. This unit is powered by four 400 h.p. Paxman engines. The 140 ft high derrick is mounted on a 30 ft square base and is capable of a maximum pull of 1,100,000 lbs.

For the storage of the various chemical materials which are required in the drilling operations, three large hoppers have been installed. These hoppers are capable of handling 140 tons of cement, 125 tons of barytes, and 80 tons of bentonite. Variable speed screw conveyors are employed to deliver the chemicals to the mixing tanks. In addition to the above, storage capacity has also been provided for:—

(1) 500 tons of fuel oil;
(2) 170 tons of potable water;
(3) 900 tons of drilling fresh water or ballast;
(4) 140 tons of salt water;
(5) 400 tons of mixed mud.

For cementation of the casing, etc, a Halliburton T.10 unit has been supplied which can mix and place cement slurry at the rate of 100 tons per hour. Besides cementation, mud and water circuits are connected with the aforementioned unit to enable direct



Testing the retractable legs of Adma Enterprise *in the high position.* A BP photograph

pumping up to 10,000 psi through the drill pipe or wellhead should the need arise. A Schlumberger well logging outfit is also accommodated on the barge.

Air-conditioned living and messing accommodation is provided for up to 50 people and considerable thought has been given to making this as comfortable as possible. Three 15-ton units supplied by Rudolf Otto Meyer of Hamburg will supply the air conditioning and refrigeration requirements. Fresh water will be manufactured on the barge by a flash evaporator supplied by Messrs Atlas-Werke of Hamburg utilizing the waste heat from the diesel engines. This unit has a capacity of approximately 770 gallons per hour of fresh water with five diesel engines running at full load.

The main electricity supply is 440 volts, 3-phase, 50-cycles, and is obtained from three 220 kW alternators which are driven by Davey, Paxman Type 12 RPH engines. These three units are installed in a generator house which also contains the switchboard from which the various supply circuits are controlled.

The barge is equipped with a Weserhutte W24S mobile crane capable of lifting up to 30 tons. This crane is used for landing supplies and personnel from barges which will be moored alongside. Normal servicing of the barge will be carried out by three general service launches, five 100-ton dumb barges, together with a 600-ton landing craft and a 30-ton refrigerated barge. The barge is also equipped with lifeboats and other life-saving facilities. It has a helicopter landing deck and Westland Widgeon helicopters are to be used for urgent and emergency communication between the barge and the base on Das Island in the Persian Gulf. Radio telephone equipment is installed for normal communication with the island base.

On arrival at Das Island, the outfitting will be completed and the barge will be towed to the drilling site, some 20 miles away. There the legs will be lowered to the sea bed and the barge elevated to its working position, which will be approximately 40 ft above high water level. Drilling is due to begin early in 1958.

OIL COMPANIES EQUIPMENT ORDERS

Figures compiled by the Oil Companies Materials Secretariat, and issued by the CBMPE, show that during the first half of 1957 orders for materials and equipment placed in the U.K. by oil companies were valued at £65,993,098. Details given below show that there was a considerable decline in the second quarter of the year in comparison with the first.

Compared with 1956, when the first half-year figure was £74,772,895 the 1957 figure is considerably less. The 1956 annual total was £153,680,621. For the last quarter of 1956 the total was £39,509,573.

	1957	
	Jan–March £	*April–June* £
Geophysical and other exploratory equipment, etc.	54,414	14,061
Specialized equipment for oil drilling and production including oil casing, tubing, etc.	5,329,341	4,552,068
Specialized equipment for oil refineries, etc. (not including pumps and valves)	1,488,798	735,339
Drums and can-making, filling and cleaning equipment, kerbside pumps and other oil metering and dispensing equipment, etc.	154,309	162,447
Railcars, road tankers, aircraft refuellers, etc.	52,834	3,837
Drums, drumsheets, and tinplate	1,974,870	1,137,401
Tankage (including tank fittings)	643,483	586,191
Tubulars, pipe fittings, and valves (ferrous and non-ferrous)	5,181,181	5,147,192
Pumps (excluding slush, oil well, and kerbside)	538,444	553,719
Boilers, boiler house plant and accessories, etc.	105,653	29,173
Electrical equipment—motors, generators, transformers, etc.	1,916,471	2,125,037
Instruments, meters, and gauges, etc.	358,293	413,186
Prime movers and compressors	669,265	644,672
Machine and hand tools, welding and miscellaneous machinery and stores	3,701,142	2,696,570
Ferrous and non-ferrous plates, sections, sheets, and bars	3,214,687	2,120,977
Automotive equipment, all types	1,766,344	1,816,862
Laboratory equipment and chemicals, including hospital and medical supplies	357,379	255,886
Bulk chemicals, catalysts, barytes, etc.	5,101,551	4,567,114
Cement and other building materials and hardware, including timber	1,813,367	856,724
Commissary, general requisites for office, warehouse, household, club and sports, etc.	1,626,877	1,525,939
	£36,048,703	£29,944,395

Trade Literature, etc.

Bender Sweetening Process

The Petreco-Bender catalytic sweetening process is described in a leaflet issued by Petreco, Petrolite Corpn., 3202 South Wayside Drive, Houston 1, Texas, U.S.A. The process is used to sweeten light hydrocarbons by converting mercaptans to disulphides through oxidation.

Staffa Cranes

Chamberlain Industries Ltd, makers of "Staffa" mobile and shop cranes, announce their first order from an Iron Curtain country for their 2-ton hydraulic shop crane. It has been purchased by a trading company serving heavy industry in Hungary. Further orders are anticipated.

B.K.L. Alloys Ltd

B.K.L. Alloys Ltd of Birmingham, makers of *Tubend* seamless welding fittings, have opened a London office for sales in London and the Home Counties. C. M. Powell will be in charge of the new offices at 16 Berkeley Street, W.1 ('Phone: MAYfair 2779).

Wax-Moulding Machine

Details of the "Greer" automatic wax-moulding machine, which produces 10½-lb slabs of wax direct from liquid storage to complete slab, can be obtained from Paterson Hughes Engineering Co. Ltd, Bedford House, Bedford Street, London, W.C.2. A throughput of 15,000 lb per hour is claimed.

BTR Industries Ltd

By changing its name to BTR Industries Ltd the British Tyre & Rubber Co. Ltd emphasizes that its expanding production facilities are being applied on an ever-broadening basis to the development and manufacture of rubber, plastics, etc, for widespread use in many basic industries. Work is well advanced on the new £2-million factory at Farington, Lancs., and an extension at Burton-on-Trent.

New Domestic Fuel Oil

Mobilheat VB, introduced on the U.K. market by Mobil Oil Company Ltd at the end of August, is intended for use in the modern small oil-burning domestic boilers which operate without pressure on the oil itself. The oil is claimed to give trouble-free operation in forced- or natural-draught vaporizing units and to have largely overcome the problem of carbon formation and deposition.

New Molybdenum Disulphide Lubricant

Rocol Ltd early in September placed on sale to all users of I.C. engines "Molyspeed", a suspension of molybdenum disulphide in SAE 30 premium motor oil as an additive for automobile engine oils. It is claimed that the addition of ½ pint of this additive to one gallon of oil gives considerable advantages, including easier starting, reduced wear, more power, more miles per gallon. Retail price of the ½-pint tin is 15s.

Brochure Describes New Water Flood Product by Tretolite

Fludex, a new water flood and water disposal stimulator, is fully described in an illustrated brochure recently issued by the Tretolite Company of 369 Marshall Avenue, St. Louis 19, Missouri, U.S.A. It is claimed to be an excellent wetting agent and an effective bacteriostatic agent for the control of sulphate-reducing organisms, a corrosion inhibitor, and a scale preventive.

Castrol Lubrication Charts

The latest Castrol lubrication charts cover the following models: Hillman Husky, Singer Gazelle, Vauxhall Victor, Volkswagen (1953-7 models), Wolseley 1500, McCormick International B-250 Tractor.

Copies of these charts, which measure 22 x 17 inches and are printed in two colours, may be obtained free on application to the Castrol Chart Library, 46 Grosvenor Street, London, W.1.

"Vista" Mask for Toxic Atmospheres

The "Vista" mask, manufactured by Siebe, Gorman & Co. Ltd, Chessington, Surrey, is an apparatus approved by the Ministry of Transport for work or rescue in tankers. The five salient features of the mask are: (1) can be tested for air tightness before entry into a toxic atmosphere; (2) can only be worn with harness and lifeline; (3) safety line is permanently fixed; (4) inlet valve reduces fogging; (5) blower can be left unattended.

The "Barton" Meter

Sunvic Controls Ltd are to manufacture under licence in the United Kingdom, the differential pressure meter developed by the Barton Instrument Corpn of California. Using two mechanically-linked, liquid-filled bellows, this instrument provides rotation of a torque tube which corresponds to changes in applied differential pressure. The torque arm can be coupled to a pressure transmitter (such as the Sunvic Model 17) to provide an output of 3-15 psi; it can also be linked mechanically to an indicating gauge or recorder. It can be used in temperatures down to – 25° F, recommended max temperature for continuous duty being 200° F. Standard differential pressure ranges are from 0–20 inches w.g. up to 0–200 inches w.g.

Oil Industry Pipe Supplies

In order to meet the growing demands of the oil industry for tubing and linepipe, Stewarts and Lloyds Ltd have made preliminary arrangements with John Summers & Sons Ltd for the supply of steel strip for the manufacture of electric resistance welded linepipe.

A new resistance welding plant is to be erected by Stewarts and Lloyds close to the Shotton works of Summers. Here, tube in the 6½ to 16 inch outside diameter range will be produced and the plant is expected to be in production early in 1960. Initially, strip requirements will be about 100,000 tons yearly and are expected to rise to 200,000 tons per annum after some years.

The new plant will also enable a larger proportion of the Company's seamless tube capacity to be used for making casing.

Crosby Valve Expansions

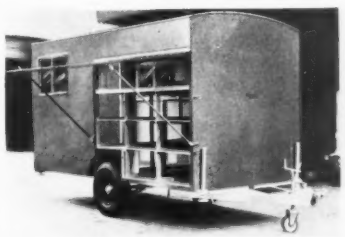
In addition to recent expansions to its machine and assembly shops and the drawing office at its Wembley factory, the Crosby Valve & Engineering Co. Ltd has also added a two-storey extension at the end of the main assembly bay. The ground floor will house increased assembly facilities and a duplicate test plant, while the second floor will be used for the assembly and testing of brass reducing and safety valves. Increased facilities for drilling and machining will also be available in a new single-storey building and a third storey is to be added to the office block.

Kent Continental S.A.

This is the title of a new company formed, in Belgium, by George Kent Ltd. Its headquarters are at 82 Chaussee de Charleroi, Brussels, and it comprises a sales, engineering, and service organization, covering the full range of Kent products, fully staffed by Kent-trained engineers. There is also a well-equipped workshop, and a comprehensive stock of spare parts is held.

Maintenance Workshop and Stores Caravan

A special two-wheel trailer caravan for insulation materials has been supplied to the Esso Petroleum Company for use as a mobile maintenance workshop and stores in and around their Fawley refinery.



Designed for a loading of 25 cwt, it is equipped with a rear door, two side windows, two side opening panels with securing struts, and open storage racks. A detailed specification is available on request to Wessex Industries (Poole) Ltd, Dolphin Works, West Street, Poole, Dorset.

New Coolant Valve and Burner Control

Teddington Industrial Equipment Ltd announce a new coolant valve to meet a demand for a thermostatic valve for water-cooled diesels. The "Waxtrol" has wax-filled elements, each element providing a movement of 0·35 inch for a temperature change of 25° F, the number depending on the flow required.

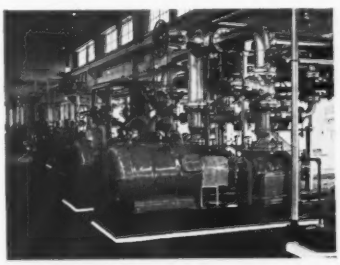
The company also announce the "Spediflam II", an oil-burner control box only 6½ inches by 5 inches by 3¾ inches in size and less than 5 lb in weight. Various models are available and details can be obtained from the Company.

Improved Lithium Greases

Since the introduction in the U.K. in 1950 of the Shell Alvania greases, based on lithium 12 hydroxy stearate, research and development at Thornton Research Centre has led to the incorporation of an inhibitor which is claimed to give outstanding anti-corrosion properties even when large quantities of water are present. Oxidation stability has also been improved and it is said that the new formulations can be used at higher working temperatures or for longer periods at the same working temperature than the earlier greases. The new greases are now available in the U.K. and will be available overseas shortly.

Sigmund Pumps at Shell Haven

In any petroleum refinery the pumps are called upon to operate under extremes of conditions of temperature, pressure, and rates of flow. An example of the complexity of the problem is the Shell Haven refinery of the Shell Refining Co. Ltd. About one hundred of the pumps in this refinery have been supplied by Sigmund Pumps Ltd and cover a wide range of types. Among the most important are those which, in the thermal reforming unit, deliver condensate to the debutanizer at high pressure. For this, a two-stage Type HO-HL6Y process pump is used, working at a section pressure of 200 psi and discharge of 415 psi, giving a differential equal to a head of 785 ft. Pump casing is of cast steel of 1 inch minimum thickness, being tested at 600 psi. Two of these pumps are installed, as shown in the photograph, one being a standby.



Laboratory Equipment

Two new price lists, a catalogue, and two leaflets dealing with laboratory equipment are now available from Griffin & George Ltd, Ealing Road, Alperton, Middlesex. The first price list (P.2026) is for use in conjunction with the Griffin & Tatlock catalogues 52AB and 54AB and the 25th edition of the George & Becker

catalogue. The second (P.2033) is a price list of testing apparatus for bituminous materials, aggregates, sands, etc.

A wide range of wood and metal laboratory furniture is illustrated in catalogue P.2029 and the leaflets deal respectively with the Griffin Raybox (P.2022) and the Nivoc balance (P.2024). The Raybox is a simple means of producing single or multiple light rays, and the Nivoc balance is for use in direct measurement of the force on a conductor carrying a current in a magnetic field.

Instrument Centre for Manchester

The Instrumentation Division of Costain-John Brown Ltd has recently established a branch office at 63 Brown Street, Manchester 2, to provide a local service for instrument installation and testing for the process industries. W. Brown, the area instrument engineer, is in charge.

Infra-red Spectrophotometry

Dr Wilbur Kaye, director of research for Beckman Instruments Inc, recently gave a lecture on the use of the near infra-red region in spectrophotometry at the London showrooms of Baird and Tatlock (London) Ltd. Instruments specially imported for demonstration included the IR-4 and IR-6 infra-red spectrophotometers and the DK-2 spectroreflectometer. Leaflets describing these are still available from Baird and Tatlock (London) Ltd, 14–17 St Cross Street, London, E.C.1.

SITUATIONS VACANT

Readers may reply to IP Review *Box Numbers in the fullest confidence by adopting the following procedure: Place the stamped envelope addressed to the advertiser in another envelope addressed to the Advertisement Manager of the* IP Review, *together with a note of names to which the reply should not be sent.*

AIR MINISTRY Works Designs Branch requires in London **Designer Draughtsmen** for **Bulk Petroleum Storage and Pumping Installations** experienced in one or more of the following:—(a) Storage tank layout and design; (b) pump house and plant layout; (c) development of pipeline schemes; (d) hydraulic calculations. Technical training to O.N.C. standard required. Salaries up to £1015 per annum. Starting pay dependent on age, quals., and exp. Long term possibilities with promotion and pensionable prospects. 5 day week. 3 weeks, 3 days leave a year. Normally natural born British subjects. Write stating age, quals., employment details including type of work done, to any Employment Exchange quoting Order No. Borough 605.

Senior Assistant in Sales Office required for Birmingham Tube Fittings Manufacturer supplying Oil and Chemical Industry. Duties include preparation of Quotations, Order Confirmations, Telephone Enquiries, and correspondence. Pensionable, progressive position in expanding organization. Box No. 1116, *IP Review*.

"Old-established independent London Oil Firm seeks top class **Lube Man,** familiar with wholesale and export trade. Interesting opportunity for the right man, who must be 35 years of age or older and must be able to undertake foreign travel on occasions. Please reply to Managing Director, Box No. 1117, *IP Review*, who will deal with it in strictest confidence.

* * *

IRANIAN OIL OPERATIONS

The National Iranian Oil Company hereby informs all interested persons and Companies that, in accordance with the provisions of the Iranian Petroleum Act of July 31st, 1957, any inquiries, requests for information, or proposals of any nature whatsoever in connection with the performance of petroleum operations in Iran must be addressed direct to:

THE CHAIRMAN OF THE BOARD OF DIRECTORS,
National Iranian Oil Company,
Avenue France,
Tehran, Iran.

Any communication made through other channels shall have no effect.

Forthcoming Meetings

THE INSTITUTE

(*At* 26 *Portland Place, London, W.*1, 5.30 *p.m.—tea* 5 *p.m.*)

The Impact of Cyclical Fluctuations on Fuel Oil Demand. G. Chandler, M.A., M.Inst.Pet., and D. W. Lindsell, B.Com. **6 November**

IP ESSEX BRANCH

(*At the Railway Hotel, Pitsea*, 7.30 *p.m.*)

The Petroleum Industry in A.D. 2000. Professor E. S. Sellers, M.A., M.Sc., M.I.Chem.E., F.Inst.Pet. **1 November**

(*Place of Meeting to be Announced*)

The Petroleum Chemical Industry in Gt. Britain and the United States. L. Holliday, M.A., B.Sc., M.I.Chem.E., A.F.Inst.Pet. **22 November**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

Electronic Computers. F. V. Freeborn. **1 November**

Oil Searching in the U.K. B.P. Exploration Co. Ltd. **29 November**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1, 6 *p.m.—tea* 5.30 *p.m.*)

Fuels and Lubricants in Jet Engines. N. O. Rawlinson, B.Sc., and H. C. Denly, B.E.(Mech.). **23 October**

The British Motor Industry. E. Woodbridge. **21 November**

IP NORTHERN BRANCH

(*At the Midland Hotel, Manchester*, 7.30 *p.m.*)

Annual Dinner Dance. **8 November**

(*At the Engineers' Club, Albert Square, Manchester 2*, 6.30 *p.m.*)

Technical Service and Quality Control in a Marketing Company. W. S. Ault, B.A. **19 November**

IP SCOTTISH BRANCH

(*At Recreation Hall, BP Grangemouth Refinery*, 7.30 *p.m.*

Colour Television. P. S. Carnt. **17 October**

(*At North British Station Hotel, Edinburgh*, 7 *p.m.*)

Measurement of Size of Droplets from Convergent and Divergent Nozzles used in Oil Burners for Steel Furnaces. E. J. Burton and J. R. Joyce. **Flow and Disintegration of Sheet of Visco-elastic Fuels.** N. Dombrowski, P. Eifenklams, and R. P. Fraser. (**Joint Meeting with Scottish Section, Institute of Fuel**). **21 November**

IP SOUTH-EASTERN BRANCH

(*At the King's Head Hotel, Rochester*, 7.45 *p.m.*)

Production of Aviation Gas. W. A. Partridge.

Film: *Time and the Rocks*. **12 November**

(*At Tudor House, Bearsted*).

Annual Ball. **15 November**

IP SOUTH WALES BRANCH

(*At the Training Centre, BP Refinery* (*Llandarcy*) *Ltd*, 5.30 *p.m.*)

Conversazione—conducted by Technical Dept, BP Refinery (Llandarcy) Ltd. **14 November**

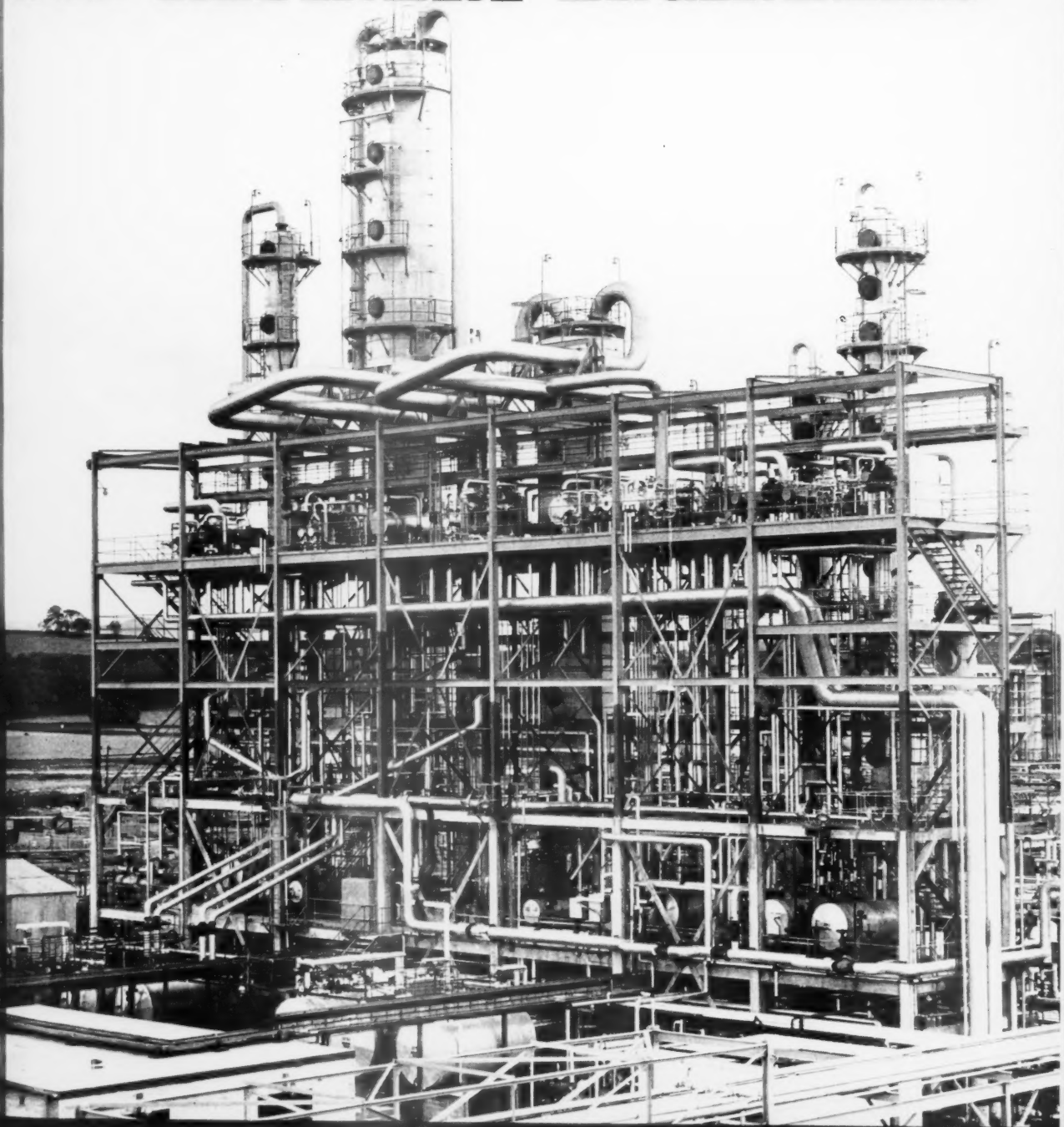
IP STANLOW BRANCH

(*At Blossoms Hotel, Chester*, 7.30 *p.m.*)

The Use of Additives in Gasoline. J. M. Foster, B.Sc.(Eng.) **16 October**

Wrought Steels for the Petroleum Industry. S. Barraclough, A.Met., F.I.M. **20 November**

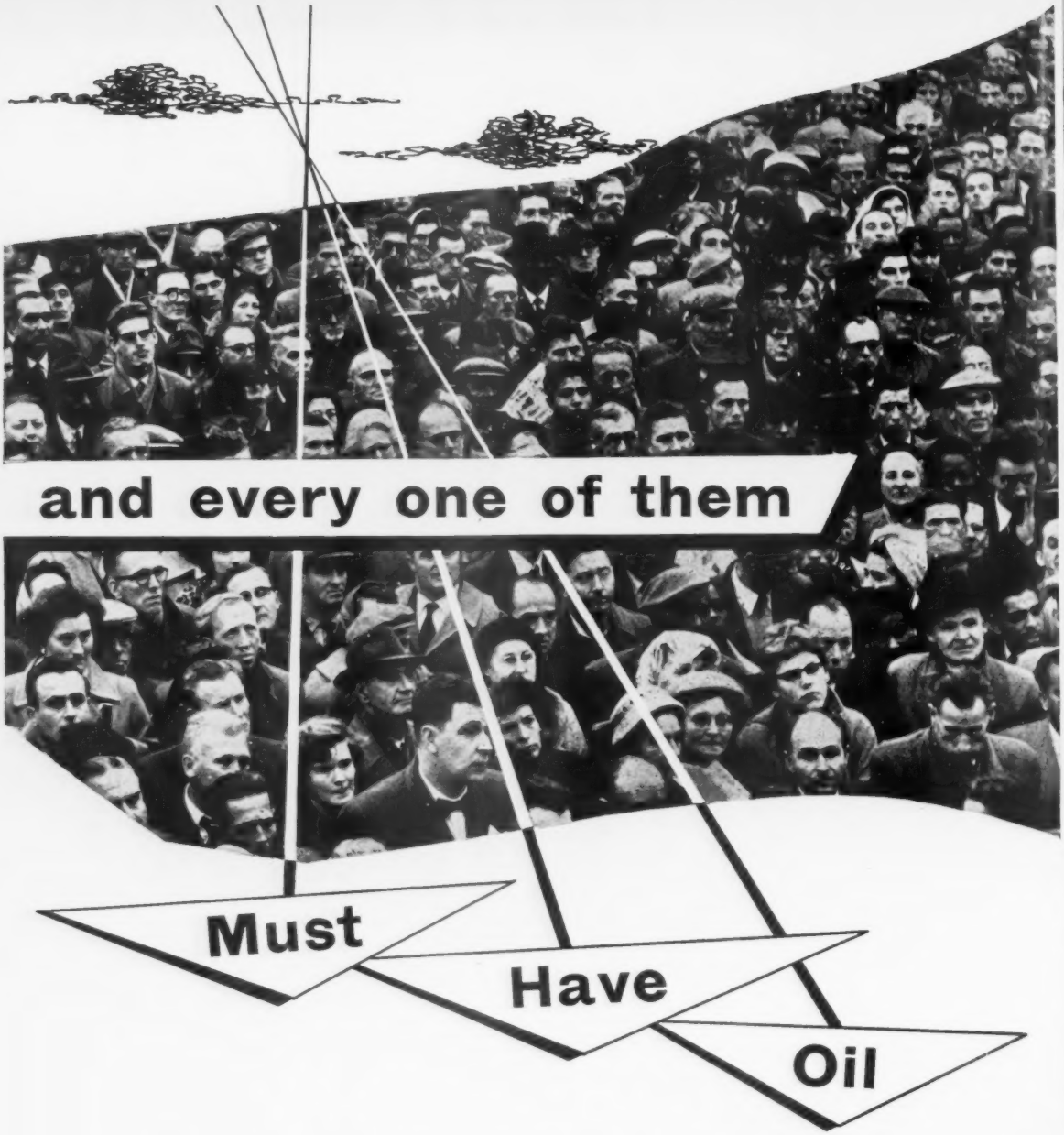
OIL REFINERY ENGINEERS



THE

MATTHEW HALL

GROUP OF COMPANIES



Oil is so automatic a part of life that, like the supply of water to homes, the ordinary person fails to remember the massive organisation required to maintain its constant supply.

The vicissitudes and processes through which oil passes before reaching the consumer, are varied and diverse as all connected with the industry well know.

Storage becomes a major operation particularly where large concentrations of population are concerned. In the case of London and Greater London the immense storage capacity of London and Thames Haven Oil Wharves Limited has long been used to ensure that consumers' demands are always quickly met.

Storage facilities at Thames Haven are being constantly extended to cater for the ever-increasing demand for oil of all kinds.

LONDON AND THAMES HAVEN OIL WHARVES LTD

3 St. HELENS PLACE, LONDON, E.C.3. *Tel: AVEnue 6444*

THAMES HAVEN INSTALLATION. *Tel: Stanford-Le-Hope 2232*

CHWR/6

FLP perfect connection

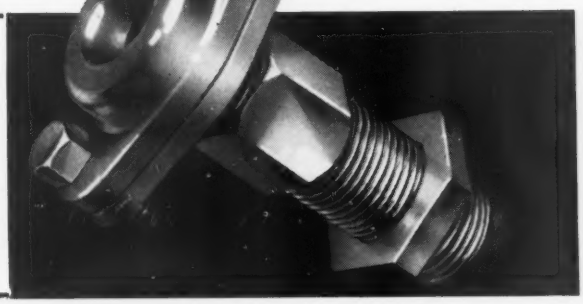
Of Armoured Cables to any industrial Buxton Certified Flameproof equipment **WITHOUT** the use of Sealing Boxes . . .

NEW Walsall

Cable Glands

BUXTON CERTIFIED GROUPS II & III CERTIFICATE No. FLP 3723 & 4

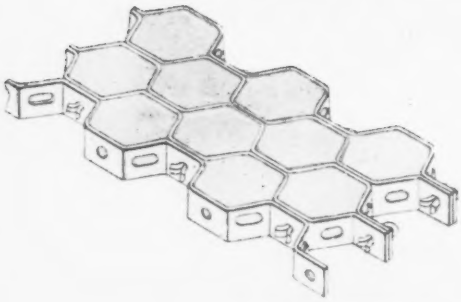
Suitable for V.I.R. or Plastic Insulated and Armoured Cables for use WITHOUT Compound Sealing Boxes. Approved for use where site conditions do not necessitate compound sealing of the cable insulant. Leaflet No FLP 51/4 available upon request.



WALSALL CONDUITS LIMITED · EXCELSIOR WORKS · WEST BROMWICH

CORROSION in Oil Refineries.

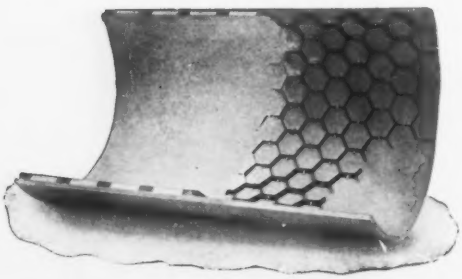
in Five Continents



HEXMETAL

is preventing fracture, and is minimising scour and erosion of protective linings

- CAT CRACKERS
- HYDROFINERS
- REACTORS
- COLUMNS
- PIPE LININGS
- CHAMBERS
- FLUES
- ETC.



Hexmetal may be supplied in mild, firebox type, or coated steel and in chromium alloys. When loaded with refractories or cements it is proof against the most severe conditions.

The patented pinned cells of Hexmetal provide strength to resist blistering and collapse of linings.

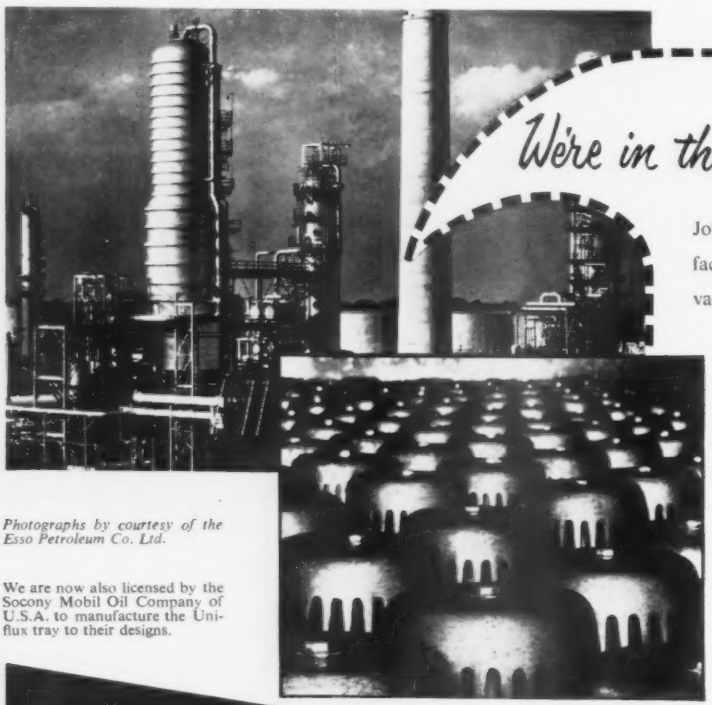
Complete fabrication of tailored and bound sections is undertaken to suit all shapes of pipes and vessels and the two-way flexible construction of Hexmetal is available for domed roofs.

Our staff will readily advise on any lining problem.

Write for literature and/or sample to:-

CAUSEWAY REINFORCEMENT LTD.

66, Victoria Street, London, S.W.1. Telephone: Victoria 8648



Photographs by courtesy of the Esso Petroleum Co. Ltd.

We are now also licensed by the Socony Mobil Oil Company of U.S.A. to manufacture the Uniflux tray to their designs.

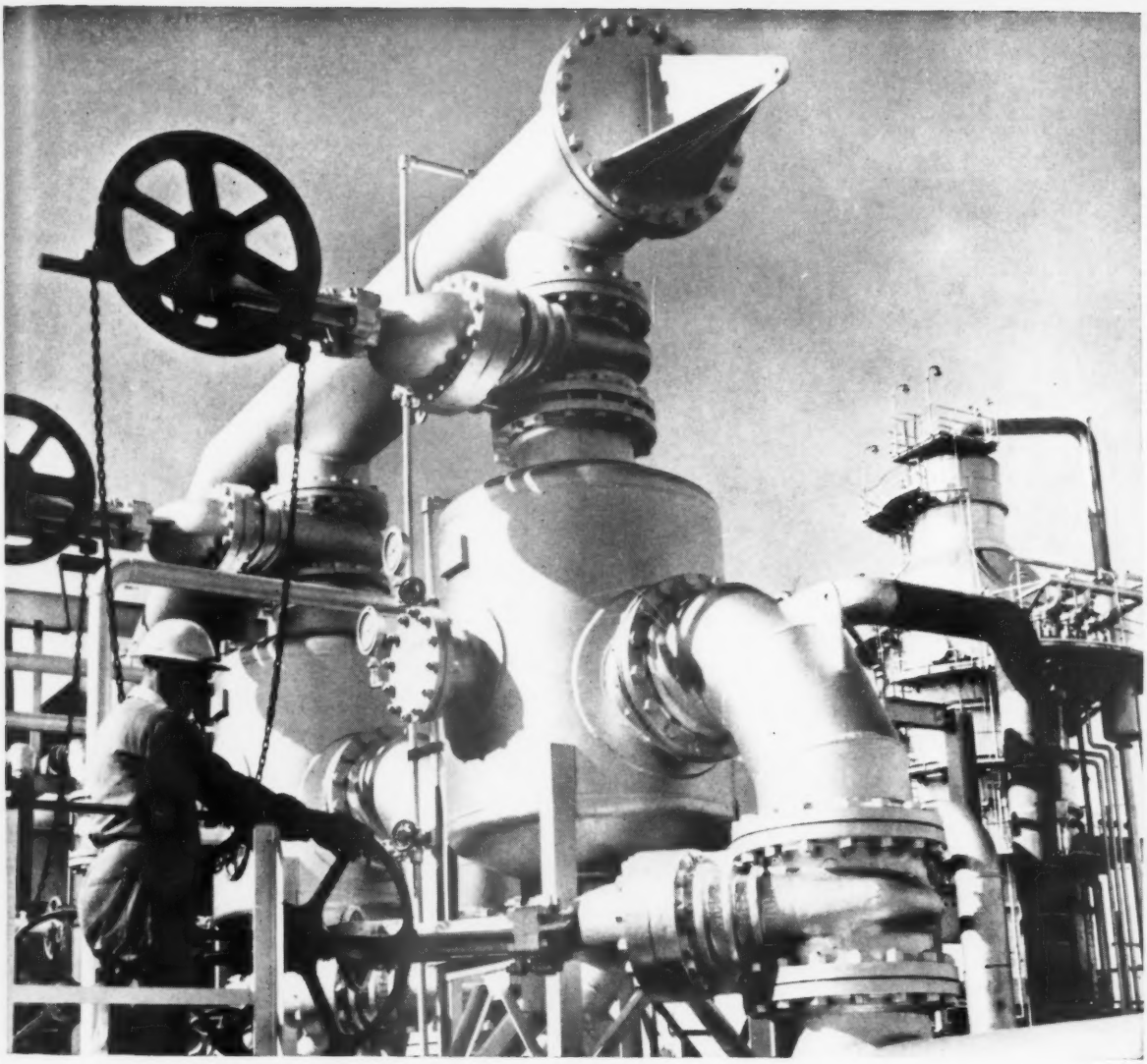
We're in the Petroleum business too!

Johnsons have great experience in manufacturing bubble decks and ripple trays of various types. The bubble decks illustrated are made in easily assembled sections to fit in with any layout of processing plant. The speed of assembly and maintenance, plus many other advantages, results in real economy. Fabricated from stainless steel, carbon steel or alloy steels, these modern trays increase efficiency in any refinery.

Johnson's

A. JOHNSON & CO. (LONDON) LTD.

Works & Sales Office: **Dukes Road, Western Avenue, Acton, W.3.** *Telephone:* **Acorn 6061**
Telegrams: **Agenticum Telex London** *Head Office:* **Africa House, Kingsway, London, W.C.2.**



BP REFINES IN AUSTRALIA

THE £A40,000,000 Kwinana refinery, the largest in the Southern Hemisphere, is situated 17 miles south of the Port of Fremantle and is operated by BP Refinery (Kwinana) Limited, one of BP's Australian Associates.

Kwinana Refinery was officially opened by the Governor General, Field Marshal Sir William Slim, in October 1955 – three and a half months ahead of schedule.

In the first year of operation the refinery processed 2,000,000 tons of crude oil, producing petrol, kerosene, diesel and fuel oil for the markets of Australia, New Zealand and neighbouring countries.

Preliminary work has now started on the new expansion scheme. This includes the erection of the latest design of catalytic reforming plant for upgrading low octane motor spirit, and the building of increased storage facilities.

Products from the refinery are marketed under the green and yellow BP Shield a familiar symbol for progress on the land, sea and air routes of the world.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON · EC2

Shell-Mex and B.P. Ltd.
are the distributors in
England, Wales and Northern Ireland
for the Shell, BP, and Eagle Groups;
Scottish Oils and Shell-Mex Ltd.
in Scotland; Irish Shell Ltd.
in the Republic of Ireland.
Behind all three companies
lie the vast and world-wide resources
of the Shell, BP, and Eagle Groups.

SHELL-MEX AND B.P. LTD., SHELL-MEX HOUSE, STRAND, W.C.2

Registered users of Trade Marks

For your Type of Body

SPECIFY — THAMES TRADERS!

NOW—A brand new truck chassis specially designed for special bodies, including; Articulated Trucks, Pantechnicons, Luton Vans, Refuse Loaders, Horse Boxes, Coaches, Cesspool Emptiers, Meat Trucks, Refrigerated Trucks, Tippers, Kerosine Tankers, Ambulances, Bulk Cement Carriers, Water Tankers, Heavy-Duty Pick Ups, Civil Defence Vehicles, Tar Spraying Vehicles, Crew Cars, All-metal Stake Bodies, Fire Tenders, 4-wheel drive Power Wagons, Food Trucks and all types of industrial and commercial vehicles.

NOW—New Thames Traders from Ford Motor Company Limited, England . . . available in the full range—15, 20, 30, 40, 50 and (available soon) the giant capacity 70 . . . all with great advances in commercial vehicle engineering.

NOW—*Forward Control* giving increased load capacity—greater PAYLOAD SPACE BETWEEN AXLES. The Trader has *better* weight distribution and *greater* carrying capacity for *less* overall length.

NOW—Outstanding advances in cab comfort . . . better ventilation and insulation for hot and cold climates . . . more room . . . more style (15 full gloss cab colour combinations!) . . . and more visibility with the largest, safest single-piece curved windscreen ever!

NOW—Brilliant new features for extra power—extra performance . . . new synchro-silent transmission . . . new finger-light steering . . . synchronised, massacre-proof springing . . . two leading shoe brakes front and rear . . . new full length *flat* chassis . . . and . . . new high standards of accessibility for routine service.

4-Cylinder Dagenham-made Diesel Engine
OR
4-Cylinder Petrol Engine
for 15, 20 and 30 Thames Traders

NOW—NEW
6-Cylinder 108 B.H.P. Dagenham-made Diesel Engine
OR
NEW 6-Cylinder 118 B.H.P. Petrol Engine
for 40, 50 and 70 Thames Traders

Both delivering over 252 lbs/ft torque

NOW—New Thames Traders bring you the greatest ever combination of efficiency and economy—and that (as always) includes the World's *finest* service. Now, with Thames Traders you move *more* goods more efficiently at *less* cost.

FOR FULLEST DETAILS—SEE YOUR DEALER—NOW!

FORD ENGLAND

THAMES TRADERS!

WITH 6 and 4 CYLINDER DIESEL AND PETROL ENGINES

FORD MOTOR COMPANY LTD · DAGENHAM

The "WEIR VALVE" CAST STEEL WEDGE GATE VALVE to B.S. 1414

✻ *Manufacture*

Made by an Associated Company of THE WEIR GROUP and conforming to the high standard of workmanship and efficiency attributed to this well known organisation.

✻ *Design*

Fully in accordance with the requirements of British Standard 1414, and the leading Oil Companies' individual specifications.

✻ *Materials*

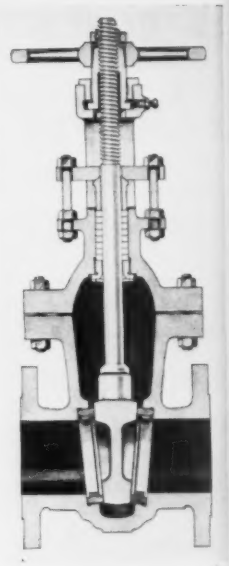
Accurate control of all constituent materials used in construction ensures that the valves are consistently up to specification.

✻ *Range*

Sizes 2" to 12" in Class 150 lb. and Class 300 lb. The standard trim material is the 11-13% Chrome Stainless Steel, but alternative materials can be offered when necessary.

DIMENSIONS IN INCHES

	Bore	Flange Diameter	Flange Thickness	F to F	Raised Face Dia.	Raised Face	Height
CLASS 150	2	6	¾	7	3¾	1/16	18¾
	3	7½	¾	8	5	1/16	22¾
	4	9	15/16	9	6 3/16	1/16	27
	6	11	1	10½	8½	1/16	35¼
	8	13½	1⅛	11½	10¾	1/16	45
	10	16	1 3/16	13	12¾	1/16	53½
	12	19	1¼	14	15	1/16	60½
CLASS 300	2	6½	¾	8½	3¾	1/16	20¾
	3	8¼	1⅛	11½	5	1/16	24¾
	4	10	1⅛	12	6 3/16	1/16	30¼
	6	12½	1 3/16	15¾	8½	1/16	39½
	8	15	1⅜	16½	10¾	1/16	47½
	10	17½	1½	18	12¾	1/16	56¾
	12	20½	2	19¾	15	1/16	63¾



The TRENT VALVE CO. LTD.

47 GREAT EASTERN STREET · LONDON E.C.2

Phone: Bishopsgate 7309 and 9404

Grams: Trenvalve, London, Telex. Telex No. 23674

TRENT

Manufactured at:
Weir Valves Ltd., 95 Coltness Street, Queenslie Industrial Estate, Glasgow, E.3.

Advertisers

	PAGE
Audley Engineering Co Ltd	Aug.
Anchor Chemical Co Ltd	Sept.
E. B. Badger & Sons Ltd	inside Back Cover
British Petroleum Co Ltd, The	xvii
British Thomson-Houston Co Ltd, The	Aug.
W. J. Brooker Ltd	iii
Causeway Reinforcement Ltd	xvi
Consolidated Pneumatic Tool Co Ltd	Sept.
A. F. Craig & Co Ltd	vii
Dewrance & Co Ltd	Sept.
Dorr-Oliver Co Ltd	Sept.
Electrothermal Engineering Ltd	Sept.
Elliott Bros. (London) Ltd	—
English Electric Co Ltd, The	v
Esso Petroleum Co Ltd	ix
Evertaut Ltd	Sept.
Fawcett-Finney Ltd	Sept.
Fina Petroleum Products Ltd	Sept.
Fischer & Porter Ltd	ii
Fisher Governor Co Ltd	i
Ford Motor Co Ltd	xix
Fothergill & Harvey Ltd (Tyglas)	Mar.
W. J. Fraser & Co. Ltd	xii
A. Gallenkamp & Co Ltd	Sept.
Geophysical Prospecting Co Ltd	Sept.
Matthew Hall & Co Ltd	xiii
John Harper & Co Ltd	Sept.
W. C. Holmes & Co Ltd	Sept.
Honeywell-Brown Ltd	Aug.
Hydronyl Syndicate Ltd	ii
International Paints Ltd	Sept.
Island View Storage (Pty) Ltd	ii
A. Johnson & Co (London) Ltd	xvi
Kellogg International Corporation	viii
Fried. Krupp	Sept.
Lake & Elliot Ltd	Sept.
J. Langham Thompson Ltd	May
London & Thames Haven Oil Wharves Ltd	xiv
M & C Switchgear Ltd	Sept.
A. & J. Main & Co Ltd	Sept.
Marconi's Wireless Telegraph Co Ltd	xi
Metal Containers Ltd	Back Cover
Metal Propellers Ltd	Sept.
Metropolitan-Vickers Electrical Co Ltd	Apr.
Mobil Oil Co Ltd	vi
Moon Brothers Ltd	Apr.
Motherwell Bridge Contracting & Trading Co Ltd	Sept.
National Benzole Co Ltd	Sept.
Nu-Swift Ltd	May
Ralph M. Parsons Company	Jan.
Peirson & Co. Ltd	May
F. Perkins Ltd	iv
Petroleum Inventions Ltd	Sept.
Petrolite Corporation	Sept.
W. Press & Son Ltd	x
Pyrene Co Ltd	Sept.
John Rabone & Sons Ltd	Sept.
Rubery, Owen & Co Ltd	July
Serck Radiators Ltd	inside Front Cover
Shell-Mex & B.P. Ltd	xviii
Shell Chemical Co Ltd	June
Shell Petroleum Co Ltd	xxii
Simmons & Hawker Ltd	Sept.
South Durham Steel & Iron Co Ltd	Sept.
Peter Spence & Sons Ltd	Aug.
Stewarts and Lloyds Ltd	Aug.
Stothert & Pitt Ltd	Sept.
Taylor-Short & Mason Ltd	May
Trent Valve Co Ltd	xx
United Steel Companies Ltd, The	Sept.
C. C. Wakefield & Co Ltd	Sept.
Walsall Conduits Ltd	xv
West's Piling & Construction Co Ltd	xxi
Whessoe Ltd	Sept.

Drilling & Production Safety Code

(Loose Leaf)

Part 4 of Model Code of Safe Practice in the Petroleum Industry

Price 12s. 6d. post free

(A 3-ring binder to hold this and three other codes can be supplied at the price of 15s. 6d.)

Obtainable from

The Institute of Petroleum
Mansion House, Portland Place, London, W.1

Firm foundations for FAWLEY

Progress of piling and slab construction for storage tank

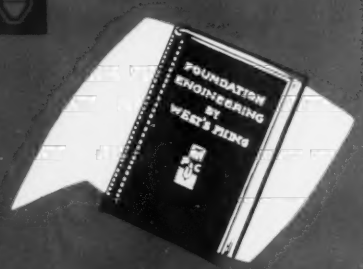
Photos by courtesy of the Esso Petroleum Company

West's Shell Piles were used at the Esso Refinery, Fawley, for pipe trestles, pump house, ballast water tank and oil storage tanks. The contract also included intricate foundation work for a cooler box.

West's Shell Piling System is a modern, mobile method of piling, combining a precast outer shell with a cast-in-situ pile core. It provides enduring support for most types of structure, particularly those imposing great weight per unit of area established, on ground of poor bearing capacity.

"Foundation Engineering", our latest publication, explains the system in detail. Please write for a copy, mentioning this announcement.

Specially designed raking frames were used to drive raker piles for the pipe trestles. These piles were designed to withstand uplift forces of up to 35 tons

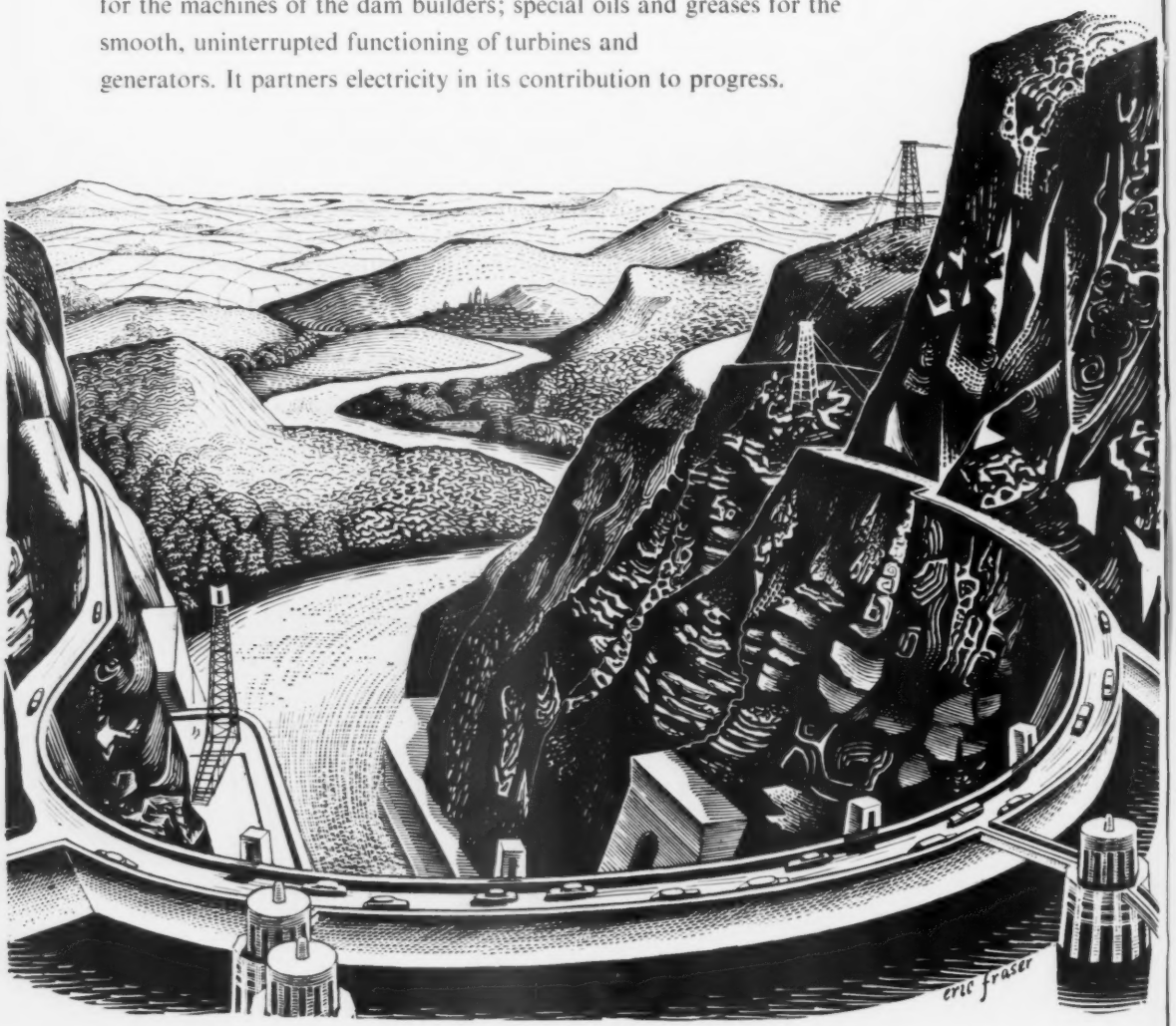


WEST'S SHELL PILING SYSTEM

WEST'S PILING & CONSTRUCTION CO. LTD.
Foundation Specialists · Design and Construction in Reinforced Concrete
BATH ROAD, HARMONDSWORTH, MIDDX. · TEL: WEST DRAYTON 2288
BRANCHES IN LONDON · BIRMINGHAM · MANCHESTER · GLASGOW
Australasia: West's Shell Piling (Asia) Pty Ltd, Melbourne and Sydney
France: Compagnie Générale de Construction de Foues, Paris

Power for Progress

Wherever the latent power of water is harnessed in the cause of industrial and civic development, oil, itself the world's main source of power, is playing its vital part. It provides fuels and lubricants for the machines of the dam builders; special oils and greases for the smooth, uninterrupted functioning of turbines and generators. It partners electricity in its contribution to progress.

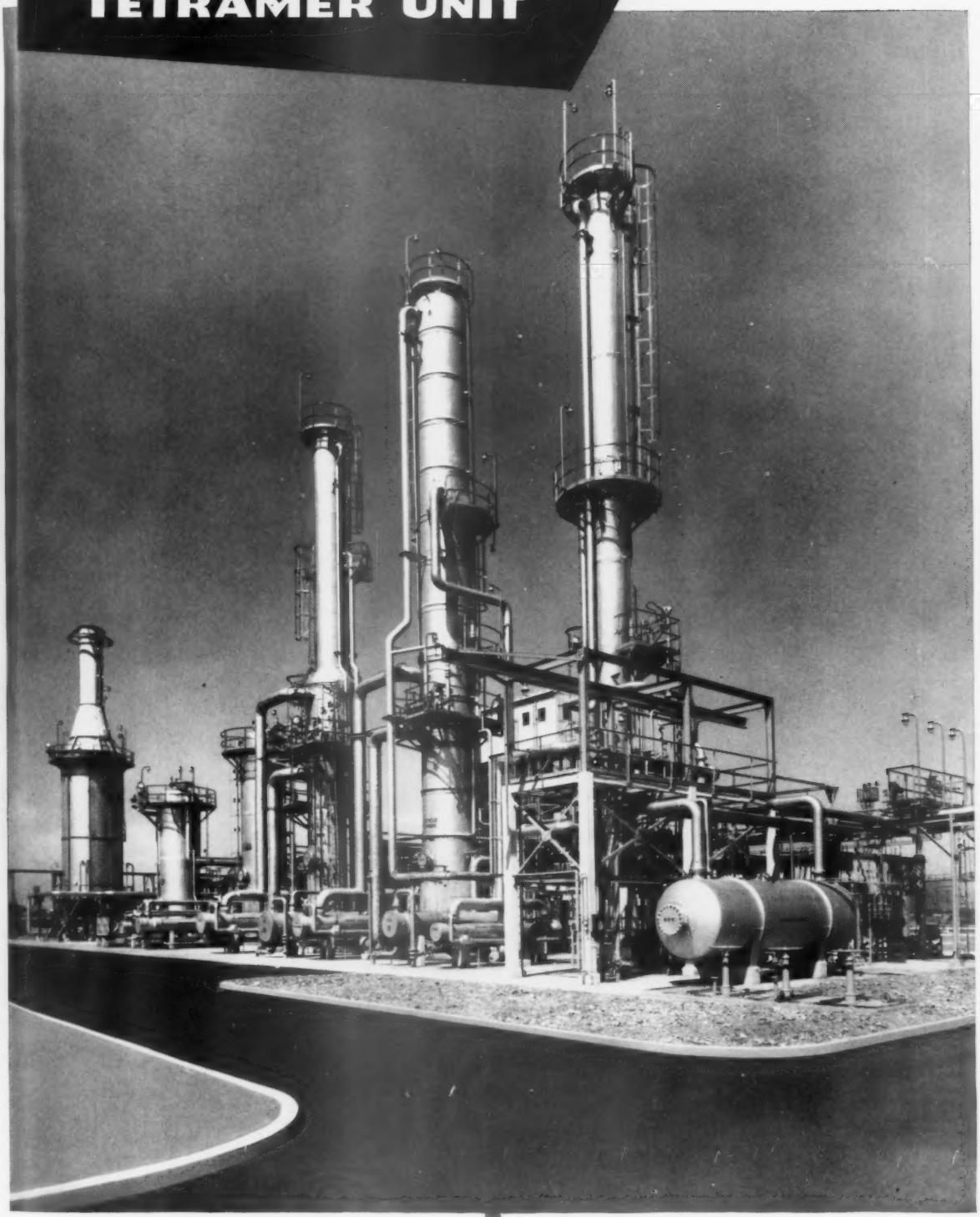


But progress is its own task master, generating new and changing demands for oil. Rich in experience, resources and skilled personnel Shell, in all its world-wide operations, is geared to the task and to the responsibility of meeting those demands.

serving progress SHELL

THE SHELL PETROLEUM COMPANY LIMITED · ST. HELEN'S COURT · LONDON E.C.3

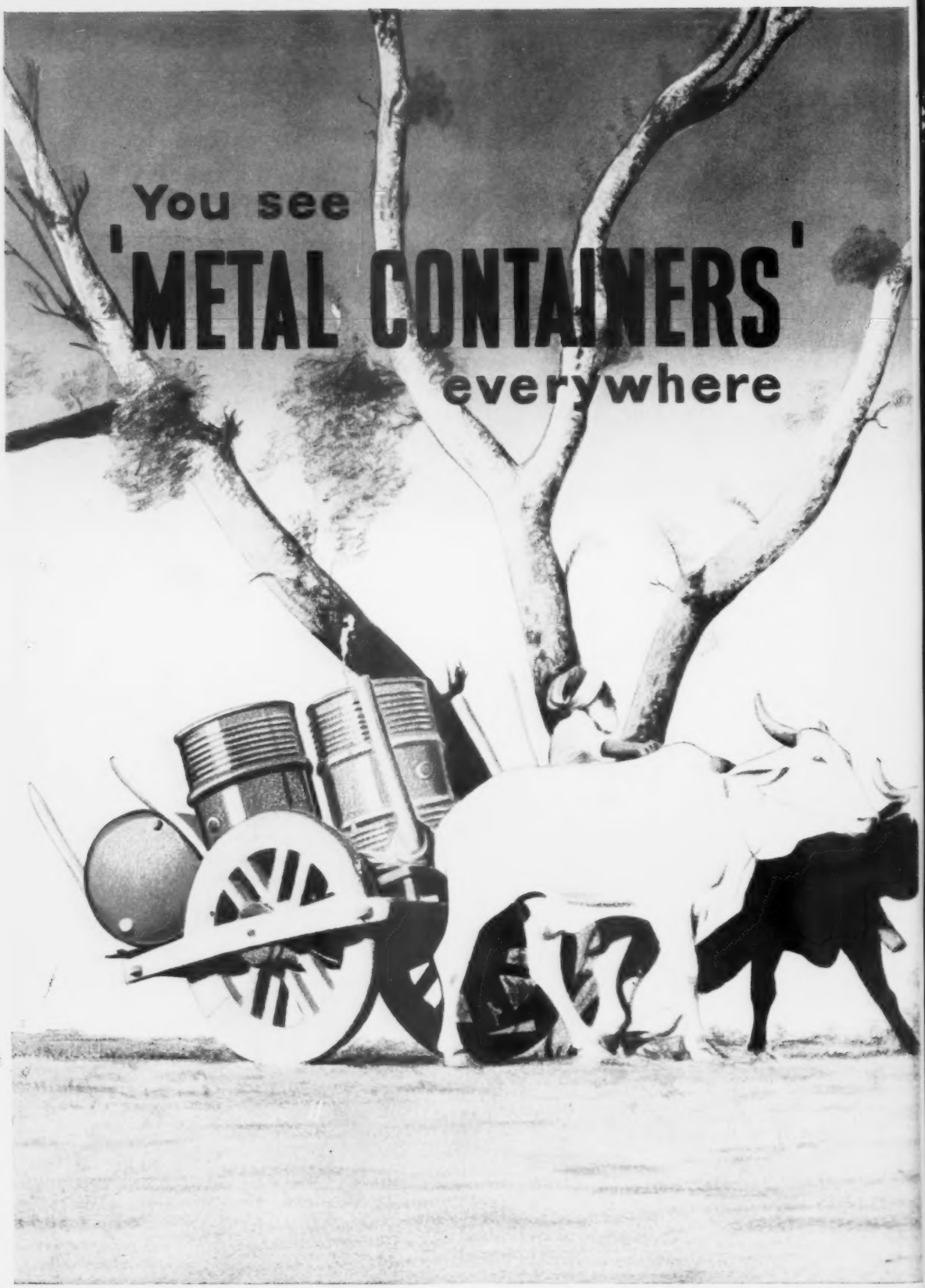
TETRAMER UNIT *



Engineered and built by
Badger for British Hydrocarbon
Chemicals Ltd.

* *Process Licensed by Universal Oil Products Company*

E. B. BADGER & SONS LIMITED
20 RED LION STREET, LONDON, W.C.1
Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries
Affiliated with
STONE & WEBSTER ENGINEERING CORPORATION, U.S.A



METAL CONTAINERS LTD., 17 WATERLOO PLACE, PALL MALL, LONDON

WORKS: ELLESMERE PORT, RENFREW & CRAYFORD

ASSOCIATED COMPANIES OVERSEAS

THE INSTITUTE OF PETROLEUM

Change of Address

On and after 1 December 1957 the offices
of the IP will be at

61 NEW CAVENDISH STREET,
LONDON, W. 1.

Telephone: LANgham 3583-4-5

Members are invited to inspect the new premises between the hours of 3 and 6 p.m. on 2 and 3 December. Tea will be provided.